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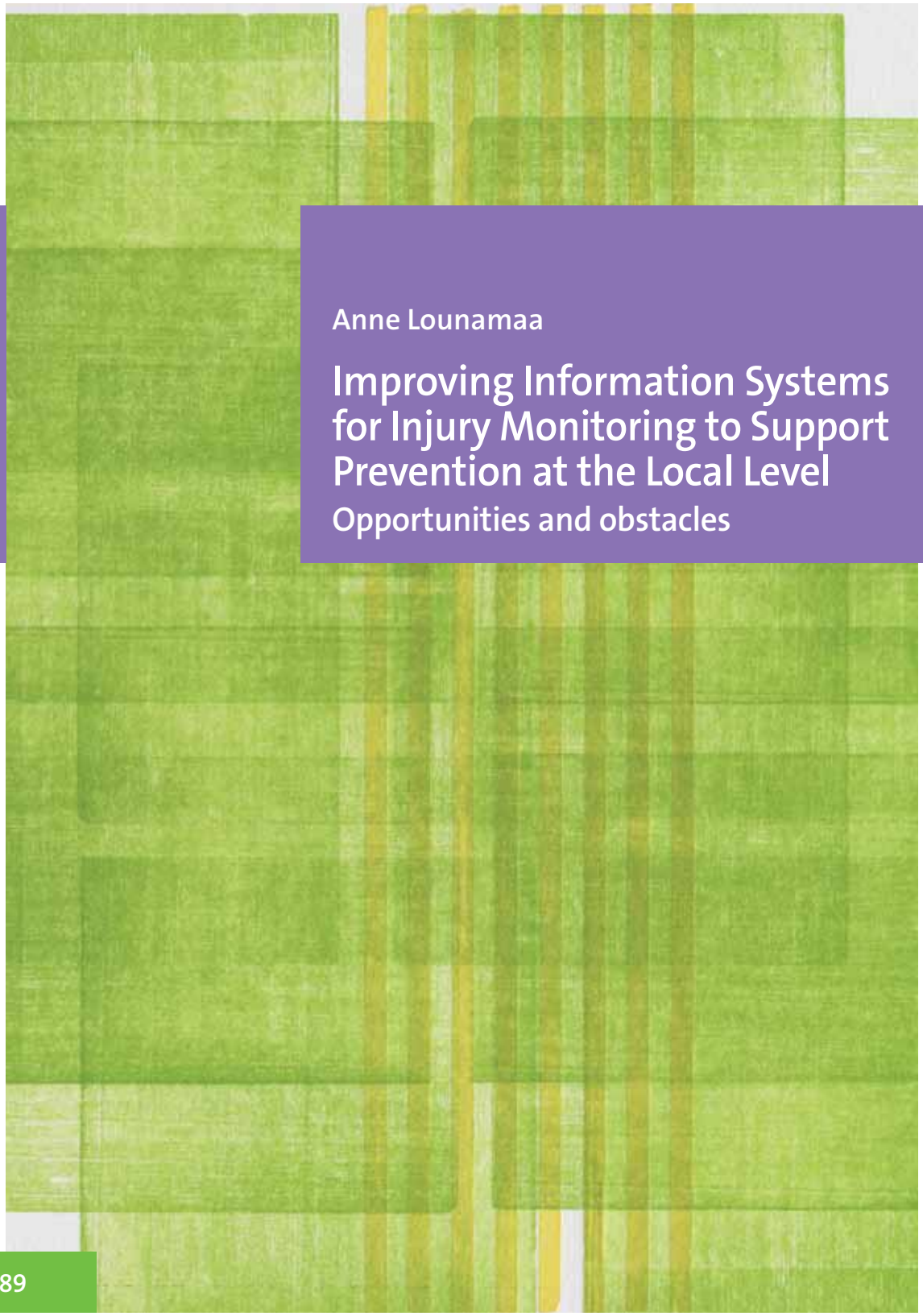

RESEARCH

Anne Lounamaa

Improving Information Systems for Injury Monitoring to Support Prevention at the Local Level

Opportunities and obstacles

RESEARCH 89/2012

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ACADEMIC DISSERTATION

To be presented, with the permission of the board of the School of Health Sciences of the University of Tampere, for public discussion in the Small Auditorium of the B-Building, Medisiinarinkatu 3, Tampere, on November 30th, 2012, at 12 o'clock.

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NATIONAL INSTITUTE
FOR HEALTH AND WELFARE

Acta Electronica Universitatis Tamperensis 1256
ISBN 978-951-44-8972-3 (pdf)
http://acta.uta.fi

Language editing: Thomas Blencowe

ISBN 978-952-245-726-4 (print)
ISSN 1798-0054 (print)
ISBN 978-952-245-727-1 (pdf)
ISSN 1798-0062 (pdf)
URN:ISBN:978-952-245-727-1
http://urn.fi/URN:ISBN: 978-952-245-727-1

Juvenes Print, Tampere University Press
Tampere, Finland 2012

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Abstract

Anne Lounamaa. Improving Information Systems for Injury Monitoring to Support Prevention at the Local Level. Opportunities and obstacles. National Institute of Health and Welfare (THL). Research 89. 217 pages. Helsinki, Finland 2012.
ISBN 978-952-245-726-4 (print), ISBN 978-952-245-727-1 (pdf)

An alignment among injury prevention researchers exists that injury prevention at the local level is one level in which injury prevention ought to be implemented. To strengthen injury prevention activities in local communities is also one target area in the national health and safety policies. Local level injury data can provide a powerful stimulus for action and guidance on prevention.

This study was undertaken to gain knowledge about local injury monitoring and the possibilities to enhance it. Four independent, but interrelated studies were conducted. The individual aims of each study are 1) to increase understanding of local practitioners' viewpoints on injury monitoring, 2) to increase knowledge on factors associated with the process of developing emergency department (ED) based injury data collection in the Finnish context, 3) to increase knowledge of the possibilities that national data sources have to enhance local injury monitoring and 4) to assess the potential of national health and safety recommendations for enhancing injury monitoring for local prevention.

The research uses a variety of qualitative data. Focus group interviews were the main data collection method in the study on local viewpoints on injury monitoring. Altogether 48 employees attended six group interviews. Data for the study of initiating injury registration in EDs comprise key informant interviews, project participation, researcher's own notes and minutes of the meetings. In total 10 people were interviewed, of which three were employees in primary health care, four in specialised medical care and one from each of the project management, the IT-company and the municipal administration. Data, for the third study on the potential of national data sources, include scientific articles, grey literature, expert interviews and other forms of personal communications with experts who work in the national data collecting organisations. Reports from committees, working groups, and commissioned studies and memorandums from the relevant ministries form data for the fourth study to assess the potential of national recommendations on local injury monitoring.

Local injury prevention practitioners have multitudinous data needs that change and extend rapidly as the local injury prevention programmes develop. Instead of investments in creating sustainable monitoring, short-term data collections on narrowly defined injury topics are common in local communities. Two different aims seem to justify injury monitoring and data requests. The first justification is to con-

duct evidence based injury prevention: to have data for planning and evaluation, to get feedback of one's own work and to conduct obligatory safety promotion work with an adequate knowledge of the injury situation. The second aim is that local practitioners propose to use injury information as a practical tool, to convince decision makers of the importance of injury prevention and to obtain sufficient resources to conduct injury prevention activities, to inform local actors and the general public, and also to educate staff on injury risks while they are collecting data. Barriers among local practitioners to conducting injury monitoring and surveillance work seem to include: limited knowledge and capacities related to available injury data sources, the data contents and whether or not the data can be accessed and to the lack of organisational readiness and resources to work with surveillance data.

A successful initiation of data collection on injuries in EDs is challenging and sensitive to several contextual factors. Existing work practices to introduce new work tasks, the alignment of injury registration with daily work routines and an intra-organisational communication culture that encourages negotiating of ambiguous cases all support the initiation of injury registration. In addition, the interviewees identified the thorough injury specific knowledge and injury research experience of the project leader strongly supporting the initiation and implementation processes. In the context of the primary health care organisation, an excessive number of injury patients, some of which had minor injuries and the busy pace of work seemed to decrease the willingness to adopt injury registration. The success and acceptability of new systems such as injury registration among the ED personnel is critically dependent on the software application that is used. It has to support the actual work process in a smooth way. Support from the municipality that intends to use the information and an alignment between the injury data collection with health and medical care organisation's other preventive goals such as prevention of alcohol-related harm seemed to support the acceptance of the injury registration.

National data sources could provide incidence and trend information on injuries for local purposes. Such information is requested by managers in the local organisations. Contrastingly, commonly requested data on injury circumstances are regularly collected for occupational, traffic and fire-related injuries only. In general, data gaps would remain even if all data collected into national information systems were used. Injuries commonly treated in ambulatory care, such as sports injuries, injuries to pedestrians or unprotected road users are currently not well represented in the national data. The assessment of the national data sources also raised concerns about data quality. Data accuracy on injury specific variables is to a large extent unknown. However, national data sources in Finland rate well on timeliness.

National data sources seem to serve local audiences poorly. Information from 22 identified national information systems that collect injury data including information on the municipalities largely remain unused at the local level. The national data collecting organisations have each developed data dissemination practices for their own audiences and, as yet, local injury prevention practitioners working with a more

comprehensive, all injuries - all ages - all situations -approach have not been sufficiently recognised as a data user group.

Since the end of 1980s more than 100 policy recommendations to improve injury monitoring have been made. Over 50% of these recommendations target improvements in the information systems' data collection processes, data contents in general or improving the data contents by the joint-use of data from other statistical information systems or changes in the specificity or accuracy of the data. Improvement of data dissemination has received less attention with 18% of recommendations targeting information system's characteristics such as data accessibility. 15% of the recommendations specifically target changes to enhance local injury monitoring. However, many of these recommendations would require organisational changes in the local organisations' work practices. These changes are not readily achievable.

A deeper understanding of local injury prevention practitioners' data needs, and the possibilities to do actual injury monitoring related work tasks can support efforts to promote the development of information systems for local monitoring. There is a need for investments in Finland to enhance data collection in EDs with injury expertise. In addition, improving data dissemination practices from national data sources could significantly improve injury monitoring at the local level. Local practitioners need to be integrally involved in these processes. These developments could be supported by national recommendations.

Keywords: injury, accident, injury monitoring, injury surveillance, injury prevention at the local level, safety promotion at local level

Tiivistelmä

Anne Lounamaa. Improving Information Systems for Injury Monitoring to Support Prevention at the Local Level. Opportunities and obstacles. [Seurantajärjestelmien kehittäminen paikallisen tason tapaturmien ehkäisytyön tueksi. Mahdollisuuksia ja haasteita.] National Institute of Health and Welfare (THL). Research 89. 217 pages. Helsinki, Finland 2012.
ISBN 978-952-245-726-4 (print), ISBN 978-952-245-727-1 (pdf)

Tapaturmatutkijoilla on yhteneväinen näkemys siitä, että tapaturmien ehkäisytyötä tulee toteuttaa paikallisella tasolla. Paikallisen tapaturmien ehkäisytyön vahvistaminen on myös tavoitteena kansallisissa terveyden ja turvallisuuden edistämisen ohjelmissa. Paikalliset tapaturmatiedot voivat kannustaa ja ohjata ehkäisevää työtä.

Neljä itsenäistä, mutta toisiinsa liittyvää tutkimusta toteutettiin, jotta saadaan tietoa paikallisen tason tapaturmaseurannasta ja mahdollisuuksista edistää sitä. Kunkin tutkimusten itselliset tavoitteet ovat: 1) Ymmärtää paremmin paikallisten toimijoiden näkemyksiä tapaturmaseurannasta. 2) Lisätä tietoa tekijöistä, jotka liittyvät tapaturmatiedon keruujärjestelmän rakentamiseen Suomen päivystyspoliklinikoilla. 3) Selvittää mahdollisuutta parantaa paikallisen tason tapaturmaseurantaa kansallisten tiedonkeruujärjestelmien avulla. 4) Arvioida kansallisten terveyden ja turvallisuuden edistämiseen laadittujen toimenpidesuositusten mahdollisuutta parantaa paikallista tapaturmien seurantajärjestelmää.

Tutkimuksessa käytetään useita laadullisia aineistoja. Paikallisten toimijoiden näkemyksiä tapaturmaseurannasta selvitettiin pääasiallisesti ryhmähaastatteluilla. Yhteensä 48 työntekijää osallistui kuuteen ryhmähaastatteluun. Tapaturmarekisteröinnin käynnistymistä päivystyspoliklinikoilla selvitettiin tutkimusaineistolla, joka muodostui avaininformanttien haastatteluista, osallistumisesta projektiin, tutkijan omista muistiinpanoista ja kokousmuistiota. Yhteensä kymmenen henkilöä haastateltiin: kolme perusterveydenhuollon työntekijää, neljä erikoissairaanhoidon työntekijää sekä yksi projektin johdosta, tietojärjestelmäyrityksestä ja kunnan hallinnosta. Kolmannessa tutkimuksessa selvitettiin olemassa olevien kansallisten seuranta- ja tilastojärjestelmien mahdollisuutta parantaa paikallista tapaturmaseurantaa aineistolla, joka sisältää tieteellisiä ja ei-tieteellisiä julkaisuja sekä tiedonkeruuta toteuttavien organisaatioiden asiantuntijoiden haastatteluja. Eri ministeriöiden komitea- ja työryhmäraportit, tilaustutkimusten raportit ja muistiot muodostivat aineiston neljänteen tutkimukseen, jossa arvioitiin kansallisten suositusten merkitystä paikallisen tapaturmaseurannan näkökulmasta.

Paikallisten toimijoiden tiedontarve muuttuu ja lisääntyy nopeasti tapaturmien ehkäisyohjelmien kehittyessä. Sen sijaan, että investoitaisiin pysyvän seurantajärjestelmän luomiseen, lyhytkestoiset tiedonkeruut kapea-alaisesti määritellyille tapatur-

mailmiöille ovat yleisiä. Paikalliset toimijat perustelivat tapaturmaseurantaa ja tiedon tarvetta kahdella eri käyttötarkoituksella. Ensimmäinen liittyy tietoon perustuvan tapaturmien ehkäisytyön toteuttamiseen: on tietoa tapaturmien ehkäisytyön suunnitteluun ja arviointiin, saadaan palautetta omasta työstä ja lakisääteiset työtehtävät voidaan hoitaa riittävän tiedon pohjalta. Toiseksi seurantajärjestelmien tuottama tieto nähtiin käytännön työvälineenä. Paikalliset toimijat perustelivat tiedon tarvetta voidakseen puolestaan perustella päättäjille tapaturmien ehkäisytyön tärkeyttä, saadakseen riittävästi resursseja ehkäisevän työn toteuttamiseen, tiedottaakseen paikallisille toimijoille ja kansalaisille sekä kouluttaakseen työntekijöitä havaitsemaan tapaturmavaaroja. Paikallisten toimijoiden tapaturmaseurannan toteuttamisen esteet näyttävät liittyvän puutteellisiin tietoihin olemassa olevista tapaturma-aineistoista, aineistojen sisällöistä ja mahdollisuudesta käyttää aineistoja. Puutteena on myös paikallisten organisaatioiden valmius järjestää resursseja työntekoon tapaturma-aineistojen parissa.

Tapaturmarekisteröinnin onnistuminen päivystyspoliklinikalla on haastavaa ja yhteydessä moniin tekijöihin toimintaympäristössä. Tapaturmarekisteröinnin alkuvaiheen käynnistymistä tukevat työyhteisössä olevat käytännöt uusien työtehtävien omaksumiseen, tapaturmarekisteröinnin sovittaminen osaksi päivittäisiä työrutiineja ja päivystyspoliklinikan sisäinen keskustelukulttuuri, joka rohkaisee keskustelemaan hankalasti luokiteltavista tapaturmatapauksista. Haastateltujen mukaan myös projektipäällikön perinpohjainen tapaturmiin ja tapaturmatutkimukseen liittyvä kokemus on merkittävä tekijä tapaturmarekisteröinnin käynnistämis- ja juurruttamisvaiheissa. Perusterveydenhuollon toimintaympäristössä tapaturmapotilaiden suuri määrä, lievät vammat ja kova työtahti heikentävät halukkuutta osallistua tapaturmatiedonkeruuseen. Tapaturmarekisteröinnin onnistuminen ja se, että henkilökunta hyväksyy tapaturmarekisteröinnin kaltaisia uusia työtehtäviä, on merkittävästi riippuvainen rekisteröintiin käytettävän ohjelmiston ominaisuuksista. Ohjelmiston on tehtävä työ sujuvaksi. Kunnalta, joka aikoo käyttää tapaturmatietoa, saatu tuki ja se, että tapaturmatiedonkeruu tukee terveydenhuollon muiden tavoitteiden saavuttamista, kuten päihdehaittojen ehkäisyä, näyttävät tukevan tapaturmatiedonkeruun hyväksymistä.

Valtakunnalliset tietoaineistot pystyisivät tarjoamaan johtajien ja esimiesten kaipaamia tietoja tapaturmien ilmaantuvuudesta ja kehityssuunnista. Toisaalta paikallisten toimijoiden yleisesti toivomaa tietoa kerätään säännöllisesti ainoastaan työ-, liikenne- ja tulipalo-onnettomuuksista. Vaikka kaikki valtakunnalliset tietolähteet otettaisiin käyttöön, jäisi silti tietoaukkoja. Valtakunnallisista tietojärjestelmistä ei tällä hetkellä saada kattavasti tietoa tapaturmista, joita yleisesti hoidetaan avovastaanotolla, kuten liikuntatapaturmista tai kevyen liikenteen ja jalankulkijoiden tapaturmista. Valtakunnallisten tietojärjestelmien selvitys herätti myös huolen tiedon laadusta. Tapaturmaspesifien muuttujien oikeellisuutta ei juurikaan tunneta. Sen sijaan, valtakunnallisten tietojärjestelmien tiedon ajantasaisuus arvioitiin tapaturmien seurannan tarpeisiin nähden hyväksi.

Valtakunnalliset tietoaineistot näyttävät palvelevan paikallisia toimijoita huonosti. Tieto 22 valtakunnallisesta tapaturmatietoa ja kuntatietoa sisältävästä tietojärjestelmästä näyttää suurelta osin jäävän paikallisella tasolla hyödyntämättä. Kansalliset tietoa keräävät organisaatiot ovat kukin kehittäneet tiedonjakelujärjestelmiä omille asiakasryhmilleen. Kokonaisvaltaista – kaikki tapaturmat, ikäryhmät ja tapaturmatilanteet käsittävää – paikallisen tason lähestymistapaa tapaturmien ehkäisyyn ei vielä ole riittävästi tunnistettu tietotarpeeksi.

Tapaturmien seurantajärjestelmän kehittämiseksi on tehty yli 100 toimenpidesuositusta 1980-luvulta lähtien. Yli puolet toimenpidesuosituksista koskee tietosisältöjen ja tiedon keruuprosessien kehittämistä, eri tilastojärjestelmiin tallentuvan tiedon hyödyntämistä toisissa tietojärjestelmissä tai tiedon tarkkuuden ja virheettömyyden parantamista. Toimenpiteitä tiedon jakamisen ja levittämisen parantamiseen suositellaan huomattavasti vähemmän. Toimenpidesuosituksista 18 prosenttia tähtäävät tiedon hyödyntämisen kehittämiseen, kuten tiedon saavutettavuuden parantamiseen. Ainoastaan 15 prosenttia suosituksista on toimenpidesuosituksia varsinaisesti paikallisen tapaturmaseurannan kehittämiseksi. Pääasiassa paikallista tapaturmaseurantaa parantavat toimenpidesuositukset edellyttävät muutoksia paikallisten organisaatioiden työtavoissa, mikä ei ole helposti saavutettavissa.

Parempi ymmärrys paikallisten toimijoiden tietotarpeista ja mahdollisuudesta toteuttaa tapaturmaseurantatyötä käytännössä tukee paikallisen tapaturmaseurannan kehittämispyrkimyksiä. Suomessa tulisi resursoida tapaturma-asiantuntijoiden johdolla tapahtuvaan tapaturmatiedon keruun kehittämiseen päivystyspoliklinikoilla. Tiedonjakelun kehittäminen olemassa olevista tietojärjestelmistä voisi myös merkittävästi parantaa paikallista tapaturmaseurantaa. Paikallisten toimijoiden tulee olla kiinteästi mukana tässä kehitystyössä ja kansallisia suosituksia tarvitaan työn tukemiseen.

Avainsanat: tapaturma, onnettomuus, tapaturmien monitorointi, tapaturmaseuranta, tapaturmien ehkäisy paikallisella tasolla, turvallisuuden edistäminen paikallisella tasolla

Abbreviations

CDC	Centres for Disease Control and Prevention, USA.
ED	Emergency department. This is a medical treatment facility specialising in acute care of injured patients who present without prior appointment. An emergency department is found in a hospital or primary care centre.
EFISS	Evaluation framework for injury surveillance systems (Mitchell et al. 2009)
FAII	Federation of Accident Insurance Institutions
FMIC	The Finnish Motor Insures' Centre.
ICD	International Classification for Diseases.
KELA	Social Insurance Institution of Finland
MDS	Minimum data sets for injury surveillance as recommended by WHO (Holder et al. 2001).
MELA	Farmers' Social Insurance Institution
PATJA	The information system of police affairs
PRONTO	The database of the fire and rescue service's official register of incidents.
OSF	Official Statistics of Finland
THL	National Institute for Health and Welfare (Research and expert organisation under the Ministry of Social Affairs and Health in Finland)

Contents

1 Introduction

In Finland around 3 000 people are killed annually and 100 000 hospital discharges are recorded each year due to injuries. The number of patients treated in ambulatory care is estimated to be 200 times that of injury deaths (Räddningsverket 2007, 27), amounting to around 600 000 outpatient visits each year. Indeed, mortality and morbidity due to injuries and violence in Finland are above the Western European average (Bauer et al. 2009). There have been positive trends in some injury categories, for example the number of deaths in traffic accidents and both the absolute and relative incidence rates of injuries among children 15 years and under have substantially decreased during the last 30 years. However, the total injury mortality incidence rate has been increasing since 1986. (Tiirikainen 2009.) At present, though, the increasing mortality trend seems to be levelling off (OSF 2010). The fact that injuries are the number one cause of death of adolescents and working age people up to 45 years old makes injuries still a significant public health challenge (Tiirikainen 2009).

Responding to injuries requires extensive resources. When injuries lead to a premature death or permanent disability the social and economic consequences are remarkable. Even less severe injuries create a notable impact on society, resulting in work absenteeism days and functional limitations. Yearly, almost one million Finns of 15 years or older report days of being unable to conduct their every day activities normally due to injuries (Tiirikainen et al. 2007). Furthermore, injuries disproportionately affect people of low socioeconomic position (Krug 2004; Laflamme et al. 2009; Sethi et al. 2006; Valkonen et al. 2007).

An injury is defined as a bodily lesion at the organic level, resulting from acute exposure to energy (mechanical, thermal, electrical, chemical or radiant) in amounts that exceed the threshold of physiological tolerance. In some cases (e.g. drowning, strangulation, freezing) the injury results from an insufficiency of a vital element. (Holder et al. 2001, 5.) The main diagnostic system for injuries in the field of health is the International Classification for Diseases, tenth edition (ICD-10). In this system injuries are classified by trauma and by the external cause of the injury.

Tapaturma is a Finnish language term, the concept of which includes both accidents and injuries. The word *tapaturma* is commonly used both in everyday language and official documents, such as national health promotion strategies. It is important to note that the word only refers to unintentional injuries. This has implications for the handling of injury prevention in general, and also in this study. This study mostly deals with *tapaturma*, i.e. unintentional injuries. For the Finnish speaker the existence of the concept *tapaturma* may complicate understanding of the WHO logic in classifying injuries into unintentional and intentional ones. Perhaps these conceptual reasons are associated with a gap between prevention of unintentional injuries and violence in Finland.

In the past the term accident was widely used instead of injury. The present literature as well as injury researchers and practitioners in the field of medicine and health promotion are in favour of the term injury. It is believed that the term accident reinforces a public misconception that injuries are unpredictable and unpreventable random events, and may have led to neglect of the injury prevention area of public health (Mattila 2005, 13). Still, the concept of accident is widely used among traffic safety, occupational safety and rescue service authorities.

Injury prevention actions may take place at a national, regional, local, organisational or individual level. A widely accepted societal alignment in Finland is to enhance injury prevention at a local level, in order to achieve the national health and safety targets. Health and safety policy, target programmes and action plans adopted by the Finnish government support this enhancement (Ministry of Interior 2006; 2008; Ministry of Social Affairs and Health 2000; 2001; 2003a; 2006; 2008a). Recommendations on injury surveillance are included in many of these policy documents. Also, legislation that governs public health (Primary Health Care Act 66/1972 and changes to it in 2006, Health Care Act 132/2010) and rescue service practices (first in Rescue Act 468/2003 and later Rescue Act 379/2011) defines injury prevention and safety promotion as work tasks of public health practitioners and rescue service authorities, thus supporting the nationally adapted policy.

The public health approach of injury prevention emphasises *local* information as the starting point of preventive activities *at a local level* (Ekman et al. 2008). Information is not sufficient alone, but is necessary for injury prevention (Finch 2008; Holder et al. 2001; Horan et al. 2003; Laflamme et al. 1999; Ministry of Social Affairs and Health 2006). Continuous monitoring should be an integral part of the process of management, evaluation, and planning to improve health and safety (Tulchinsky et al. 2000, 109). The effectiveness of health systems is frequently on the political agenda due to concerns over costs and quality of outcomes, and public health and health promotion activities must be increasingly justified. Therefore, there is an increased demand for relevant information to communicate the rational of strategies, policy formulations and priorities (Tulchinsky et al. 2000, 167). Information is thus needed at a local level for leadership, to plan strategies, programmes, actions, and to assess, evaluate and communicate activities and results.

The present study aims to create better understanding of the process of enhancing an information system for injury monitoring and surveillance at the local level, and the factors associated with pursuing this aim. The study uses key informant interviews, the researcher's personal notes and observations made while participating in local and national developmental injury prevention programmes, as well as publications of committees and working groups, policy papers and minutes of such meetings as research material.

The general structure of the thesis is as follows: First, the public health principles of health promotion, safety promotion and injury prevention at local settings are presented, identifying the role and function of monitoring and surveillance in the local

work. Next, the results of a literature review on injury surveillance are presented. After summarising this body of knowledge, the specific study questions, design, methods and materials used as empirical data are presented. The empirical study uses four approaches to target the topic *monitoring injuries at a local level*. The first involves a study on local viewpoints regarding injury monitoring, the second is a case study on developing injury registration in emergency department (ED) settings, the third study investigates the potential of existing national data sources for local injury monitoring and the fourth the viewpoints of experts in ministries and national organisations on injury monitoring.

2 Local communities as the setting for injury prevention

Injuries are associated with the environment, products involved and lifestyle of a population (Berger et al. 1996, 39). The multiple causation of injury, "causal web" (Robertson 1998, 86), and the complex cultural, political, psychological, environmental and social factors associated with the events leading to an injury call for extensive approaches. A community approach in which the local population and organisations are targeted simultaneously via various channels is widely recommended for injury prevention (Gittelman et al. 2007; Howat et al. 2004; Loos et al. 2001). However, community approach can have a variety of meanings and utilise different strategies. The central concepts, perspectives (risk factor approach, health promotion approach, communities and organisations as systems approach) and models (community readiness, Safe Community framework) are shortly presented in this chapter. The last subchapter presents examples and challenges of research on injury prevention in local communities.

2.1 The concept of community

Fortmann and colleagues (1995) define communities as complex and dynamic entities situated in physical, cultural and historical contexts. Institutions, organisations and people are connected to the community by both formal systems and informal communication patterns (Mittelmark 1999; Thompson et al. 1999.). A predominant way of defining community in health promotion interventions has been along geographical borderlines e.g. by municipality (Eklund 1999; Mittelmark 1999; Perttilä 1999), but a community can also be defined in terms of the common interests of a group of people or organisations. Examples of established communities that go beyond geographical boundaries are political parties, NGO's such as the Martha organisation (the Finnish home economics organisation) or the Mannerheim League for Child Welfare, sport clubs, and sport and scout associations. These national and international communities have local organisations that often are involved in municipality based health promotion programmes. In the present study the term community-based refers to injury prevention at local, geographically defined communities.

The feasibility of the type of environment is related to the targeted injury problem. When the focus is on specific injury types such as on occupational accidents workplaces may be a rational choice and for hunting accidents hunting clubs. Regions instead of local communities may be a rational choice for targeting prevention

of highway accidents. Municipalities may be better suited environments for programmes targeting all injuries, common risk factors and lifestyles associated with injuries or common accidents like falls that may occur in several activities. Locality, practicality and manageable access to citizens are emphasised in local-community approaches (Mittelmark 1999). People living in a municipality share the same environment – local government, health care services, schools, parks, bicycle lanes and newspapers.

The term communitywide in health promotion programmes often describes large-scale programmes that are intended to involve many residents and the institutions of entire municipalities (Mittelmark 1999). Community-based health promotion represents a conceptual framework emphasising primary prevention, a population-based perspective and the special needs of those belonging to high risk groups (Merzel et al. 2003). Community-based programmes use multiple interventions and aim at change among individuals, groups, and organisations, often incorporating multifaceted strategies to create policy and environmental changes (Elder et al. 1993). Puska (2009b) argues that a host of formidable obstacles to healthy change – cultural, political, economic and psychological – exist and the aim of community programmes is to build a bridge for people and communities to minimise and overcome these obstacles. He writes that the active participation of community members and organisations and a community–research partnership will enable communities to better evaluate and solve health and social problems.

How a community is treated in community based studies varies. Thus following up community-based health promotion research is complicated. McLeroy and his colleagues (2003) categorise community-based into four categories based on the implicit constructions of the community employed by the investigators: community as setting, community as target, community as resource, and community as agent.

The term community-based often refers to community as the setting for interventions. The focus of these community-based programmes is primarily on changing individuals' behaviours as a method for reducing the population's risk of disease. As a result, the target of change may be the population, but population change is defined as the aggregate of individual changes. (McLeroy et al. 2003.)

The term community-based may also have a very different meaning, that of the community serving as the target of change. The community as a target refers to the goal of creating healthy community environments through broad systemic changes in health and safety policy, community-wide institutions and services. In this model, health status characteristics of the community are the targets of interventions, and community changes, particularly changes thought to be related to health, are the desired outcomes. Success is defined as improvement in the community indicators, such as kilometres of bicycle lanes or the amount of recreation facility space per capita, over time. (McLeroy et al. 2003.)

A third model of a community-based public health programme is to consider the community as a resource. Communities have many resources and the challenge is to

direct these resources to work together in cooperation for better health and safety. Often these kinds of interventions involve external resources and actors that aim to achieve health outcomes by working through community institutions. In this model programmes aim to organise community's resources, often across community sectors, to focus on selected health issues. A high degree of community ownership and participation is seen as essential for success in health outcomes at a population level. This model is commonly applied in community-based health promotion. Examples of public health initiatives that have applied this model include the Healthy Cities initiatives in several countries. (McLeroy et al. 2003.)

The fourth community-based model is the community as agent. The emphasis in this model is on respecting and reinforcing the natural adaptive, supportive, and developmental capacities of communities. In this model communities provide resources for meeting our day-to-day needs. These resources are provided through community institutions including families, informal social networks, neighbourhoods, schools, the workplace, businesses, voluntary agencies, and political structures. Institutions meet the needs of many community members without the benefit of direct professional intervention. The aim in these programmes is to strengthen these institutions to better meet the needs of community members. This requires a careful assessment of the community in advance of any intervention and an insider's understanding of the community. (McLeroy et al. 2003.)

2.2 Perspectives on community-based programmes

2.2.1 Risk factors

Eklund (1999) argues that in the typical community programmes of the 70's the ultimate goal was the prevention of a disease, while in more recent community programmes the emphasis is on the mobilisationof health political action by laymen and on social change enabling these kind of efforts. The community approaches, according to Eklund, in the 70's emphasised a population-based mass approach with an orientation to reduce risk factors to prevent diseases.

The core theoretical framework used in communitywide cardiovascular disease prevention research has been attributed to Geoffrey Rose (Mittelmark 1999). Rose (1981; 1985; 1993) argues that reducing health losses due to cardiovascular disease by a mass strategy provides a better approach than a high-risk strategy. He (1981) shows that to treat only the high-risk individuals does not create as much of a health gain to the community as a whole than if a large number of people exposed to a low risk is approached. But this at the same time creates what he calls the prevention paradox: "a measure that brings large benefits to the community offers little to each participating individual" (Rose 1981).

Rose (1993) argues that disease is nearly always a quantitative, rather than a categorical or qualitative, phenomenon. In chronic diseases the clinician's first con-

tact with the patient comes late in the natural history of the disease and when there is already much irreversible pathological change (Rose 1981). The population strategy attempts to remove the underlying causes that make the disease common (Rose 1985). The focus on underlying causes and risk factors has implications for preventive programme frameworks, targets, monitoring and evaluation.

The North Karelia project highlighted that the risk factors of the community were very closely linked with community life styles like the generally unhealthy diet or smoking habits (Puska 2009c). In addition these risk factors are common for several non-communicable diseases like type 2 diabetes or cardiovascular diseases. The central task was to shift the risk factor profile of the entire North Karelian population through a community-based intervention using a population strategy. The choice of the main risk factors that were intervened in was derived from international literature and this information was matched with data on the prevalence of these factors in North Karelia. Once the risk factors were agreed upon, the intervention strategy was chosen. In the case of North Karelia the population strategy and community-wide efforts were aimed towards lifestyle changes that were likely to impact the common risk factors like elevated serum cholesterol, elevated blood pressure and smoking in the population. (Puska 2009b.) Detailed and comprehensive data collection and information available from national health registers and several population surveys concerning diagnosed diseases, symptoms, health behaviour, quality of life and subjective health was used to investigate risk factors, monitor changes and to give feedback for programme planning in North Karelia (Puska 2009a).

Robertson (1998, 86) argues that even though multiple causation of injury is repeatedly demonstrated, it does not logically follow that multifactorial theories or analyses lead to rational injury prevention policy. Robertson (1998, 86 - 87) gives an example of analysing an accident where a child has fallen down from an open window. To start with it is important to understand the causal web and factors leading to that particular injury. One may think of the mother, who might have been tired or intoxicated and thus not properly supervising the child. Or one may think of the child's behaviour or characteristics, such as hyperactivity. A causal analysis of injury informs preventive approaches when it specifies factors that are substantially changeable, but Robertson (1998, 86) argues that to eliminate an injury, one needs to find a controllable necessary condition for the injury, and proceed to control that condition by means of injury prevention programmes. In the case of the falling child an environmental change, installing a window barrier, might have protected the child. He argues that "focusing on multiple risk factors in causal webs may lead astray rather than toward injury control" (Robertson 1998, 86). However, examples of effective injury prevention programmes targeting multiple risk factors simultaneously are many. Falls prevention among elderly adults is one.

2.2.2 Health promotion

The approach presented in the previous chapter emphasises prevention of chronic diseases with an orientation to epidemiological information on risk factors. The other approach is the health promotion approach emphasising empowerment of individuals and communities. In reality health and safety promotion often combines the disease-based risk reduction model and the health promotion approach. Health promotion "refers to efforts to prevent ill health and promote positive health" (Naidoo et al. 2010, xi). Nutbeam (2000, 2-3) describes health promotion as "a process, the purpose of which is to strengthen the skills and capacities of individuals to take action, and the capacity of groups or communities to act collectively to exert control over the determinants of health". The core tasks of health promotion are to develop policies to protect and promote health, to educate and inform about health and behaviour change, to work with communities to identify and meet needs and organisational development (Naidoo et al. 2010, 7). It follows that to measure processes, community empowerment and competence (Ashton et al. 1988, 110; Eklund 1999), in addition to risk factors and epidemiology of diseases or injuries, are needed.

Professionals provide support for health and towards a healthy life-style at the community level in health promotion. A process of consciousness-raising on a large scale among the population is expected to lead to more informed individual and collective actions to improve health. (Ashton et al. 1988, 61.) The underlying expectation according to Ashton and Seymore (1988, 61) is that increased knowledge and changes in attitude and understanding can lead to greater confidence and individuals can become their own health experts. According to Ashton and Seymore (1988, 110) the underlying assumption is that the good health of an individual, their family and their social group is in that individuals own interest.

According to Eklund (1999) the *Healthy Somero–Järvenpää* programme is a Finnish example of a community-based programme where action for health promotion was based on the philosophy of empowerment. The programme was characterised by a positive health concept, i.e. health as a resource, instead of a disease oriented health concept and based on participation theories instead of behaviour change theories. Indicators of change were measurements in the new way of action in health promotion instead of risk factors like smoking, blood cholesterol and blood pressure. The intended change was in health policy making processes and in health care infrastructure, rather than in disease, incidence and lifestyles.

2.2.3 Of systems and humans by Reason

The concepts presented by Reason provide other tools to structure community based accident and injury prevention. Reason emphasises the importance of systems and their ability to recognise and eliminate the causes of accidents in advance. Reason (1990, 173) distinguishes between human centred active errors and system centred latent errors. Active errors are associated with the performance of "front line" opera-

tors such as pilots or air traffic controllers, whereas latent errors are most likely to be spawned by those whose activities are removed, both in time and space, from the direct control interface: designers, managers and maintenance personnel. Reason (1990, xii) argues that the prime causes of accidents are often present within systems, in environments where people act, long before an accident sequence begins. Furthermore, according to Reason (1990, 173) attempts to discover and neutralise latent failures will have a greater beneficial effect upon system safety than localised efforts to minimise active errors.

Hazardous events are caused by the unique conjunction of several necessary but singly insufficient factors (Reason 1990, 174). Accidents in hazardous environments happen because the tensions between production in industry or everyday activity and protection create latent factors that collectively produce defensive weaknesses. These permit the random conjunctions of local triggers and active failures to breach all the barriers and safeguards (Reason 2008, 138). So both system centred latent errors and human centred active errors play a role in accident occurrences, but if the existing multiple defences fail in many ways and at many levels, e.g. at system and at person level, an accident may occur (Reason 2008, 244). Due to multiple failures at one time on many levels and in many ways it may seem that the accident occurred due to bad luck. In reality the system may have failed to recognise and eliminate the foreseeable failures. The system model views the frontline person as the inheritor rather than the instigator of an adverse event. In promoting safety it is important to investigate barriers and safeguards that have failed in adverse events and how to strengthen barriers and safeguards to prevent a recurrence (Reason 2008, 253).

Reason has pointed out that accident investigations have shifted their emphasis from technical and human failures to examining the effects of such factors as organisational processes, safety culture and regulation. His thesis is that the extremes of both views have their shortcomings and a balance between the two is needed. (Reason 2008, 5-6.) Efforts to prevent the repetition of specific active errors will have only a limited impact on safety as a whole, since the same combination of causes is unlikely to recur (Reason 1990, 174). The system approach is given support by the fact that similar situations keep provoking the same kind of unsafe acts in different people. A substantial part of the accident problem is rooted in error-provoking situations rather than error-prone people. Thus a primary function of an error and incident reporting system is to identify these error-provoking situations that Reason calls *error traps*. (Reason 2008, 5.)

Another concept pair that Reason uses is individual and collective mindfulness. Individual mindfulness is a factor at the frontline operator where as collective mindfulness operates throughout the organisation as a whole. Collectively mindful organisations work hard to extract the most value from the incident and accident data that they have. They actively seek to create a reporting culture and they work on the assumption that what seems to be an isolated failure is likely to come from the confluence of many contributing factors. Instead of applying local repairs collective

mindful organisations strive for system reforms. These organisations are preoccupied with the possibility of failure. Both individual and collective mindfulness are needed in securing safety. Individual mindfulness refers to the mental skills that would help the frontline personnel to recognise and avoid situations with a high error potential. These mental skills need to be continually managed, practiced and refreshed. An organisation ought to generate a sense of empowerment that allows frontline staff to use their judgment. The organisation's culture and its practices must remind the personnel of the hazards and to respect them. Support for individual mindfulness must be embedded in the organisation. (Reason 2008, 7, 239-253.) A person-oriented approach makes it difficult to identify recurrent error traps. But identifying and removing error traps is a crucial part of risk management and a functioning incident reporting system is essential for the discovery of error traps (Reason 2008, 257).

2.2.4 Community readiness

A community readiness model incorporates community development theory with readiness to accept prevention programmes and defines community readiness as "the relative level of acceptance of a programme, action or other form of decision-making activity that is locality-based" (Donnermeyer et al. 1997). The nine stage community readiness model provides a scale where one end of the scale is defined as community tolerance, no awareness of the problem and where the behaviour or problem is tolerated by the community leadership. On the other end of the scale there is a high level of community ownership. The nine stages in the community readiness model are: community tolerance, denial, vague awareness, preplanning, preparation, initiation, stabilisation, confirmation/expansion and a high level of community ownership. In the community ownership stage the community supports a programme and constantly reviews and revises the programme in order to proactively target specific issues in the community as problems develop. (Donnermeyer et al. 1997; Stallones et al. 2008)

Information has a specific role in the developmental stages. In the first stage there is no knowledge of the problem at the community level. In the second stage the problem is regarded as a general problem and in the third stage a general feeling that there is a local problem begins to emerge. In the preplanning and preparation stages information related to the problem is collected and in the sixth, initiation stage, community specific information is collected. In the ninth stage detailed knowledge regarding the problem and effective evaluations used to modify existing programmes and policies exist. (Donnermeyer et al. 1997; Stallones et al. 2008)

The community readiness model provides measures of six different dimensions of community readiness: 1) existing community efforts in prevention, 2) knowledge about the efforts in prevention, 3) leadership involvement, 4) a climate to support

prevention efforts, 5) knowledge about the magnitude of the problem as an issue in the community and 6) resources available to address the issue (Stallones et al. 2008).

2.2.5 Safe Community indicators

The Safe Community –framework supported by the WHO is a well known model and the set of indicators have guided several injury prevention programmes in local communities throughout the world. Lidköping, a Swedish municipality with the population of 37 000 was the first designated Safe Community in 1989. In December 2010, the number of designated members in the international network was 223. (WHO Collaborating Centre on Community Safety Promotion 2010.)

The Safe Community –model is based on the findings from the Falköping, Lidköping, Motala and other Swedish programmes (Ekman et al. 1999). Collaborative relationships between people and organisations in a municipality, coordinated measures representing different strategies, organisational structures and monitoring systems are created towards injury prevention in programmes based on the Safe Community model (Lindqvist 1993; Nilsen 2004; Ozanne-Smith et al. 2002; Schelp 1988). Injury prevention and safety promotion practices of the local communities are evaluated according to the seven indicators as they apply for membership in the international network (Ekman et al. 2008). The indicators are presented in the Table 1 below. Each of the indicators has been described and a minimal criteria for each indicator is given in the WHO Guidelines for international Safe Community network applicants and for maintaining the membership in the international network (Ekman et al. 2008).

Table 1: Safe Community Indicators

Indicator 1.	An infrastructure based on partnership and collaborations, governed by a cross-sectional group that is responsible for safety promotion in their community
Indicator 2.	Long-term, sustainable programmes covering both sexs and all ages, environments, and situations
Indicator 3.	Programmes that target high-risk groups and environments, and programmes that promote safety for vulnerable groups
Indicator 4.	Programmes that are based on the available evidence
Indicator 5.	Programmes that document the frequency and causes of injuries
Indicator 6.	Evaluation measures to assess their programmes, processes and the effects of change
Indicator 7.	Ongoing participation in national and international Safe Communities networks

2.3 Studies of community-based injury prevention programmes

The first Cochrane review of studies on the Safe Communities' model was published in 2005. The review concludes that "Evidence suggests the WHO Safe Communities model is effective in reducing injuries in whole populations. However, important methodological limitations exist in all studies from which evidence can be obtained" (Spinks et al. 2005). Studies were required to fulfill the inclusion criteria, wherein injury rates in a WHO-designated Safe Community were measured using medical care based health data or cause of death statistics and changes in injury rates within the Safe Community were compared to a comparable control area. Objective evaluations were identified for seven Safe Communities. Out of the seven objectively evaluated Safe Communities five communities showed significant reductions in injury rates, four in Sweden (Falköping, Falun, Lidköping and Motala) and one in Norway (Harstadt). Two communities, one in Australia (Shire of Bulla) and one in New Zealand (Waitakere), were unable to replicate the same level of injury reduction and to show significant changes in injury rates. The Cochrane review identified a lack of reliable injury measures and that several community-based injury intervention pro-

gramme evaluation studies reported difficulties in generating an on-going monitoring system for surveillance. (Spinks et al. 2005.)

The update of the Cochrane review in 2009 casted some doubts on the previous review and stated that "there is insufficient evidence to make a definitive statement regarding the effectiveness of the model, but enough positive evidence exists to warrant further evaluation using rigorous and consistent methodological techniques" (Spinks et al. 2009). It was pointed out that practitioners should recognise that Safe Community programmes are more likely to succeed if they include activities and strategies that have been independently demonstrated to be effective (Spinks et al. 2009).

Towner and Dowswell (2002) reviewed community-based injury prevention programmes that targeted childhood injury. They conclude that there is increasing evidence about the effectiveness of community-based injury prevention approaches, and identified important elements. According to Towner and Dowswell (2002) long-term strategy, effective focused leadership, multi-agency collaboration, tailoring to the needs of the local community, the use of local injury surveillance, and time to coordinate existing and develop new local networks appear to be important for success in large scale community-based injury prevention programmes.

Original studies of large scale community-based injury prevention interventions are numerous. These studies have reported greater reductions in the study area than in the control area in the overall injury rates in the local community for both outpatients and patients discharged from hospitals (Bjerre et al. 2000), reductions in targeted, specific injury types, e.g. childhood injury rates (De Leon et al. 2007; Lindqvist et al. 2002; Svanström et al. 1995), traffic injury rates (Ytterstad et al. 1995), work-related injury rates (Lindqvist et al. 1999b), injury occurrence rates in private homes (Lindqvist et al. 1999a) and fracture rates from falls in private homes (Ytterstad 1996). Community wide injury prevention programmes have also been successful in increasing safety practices, such as bicycle helmet use and car seat use among children (Klassen et al. 2000).

Merzell (2003) has pointed out that the evidence from health promotion programmes employing a community-based framework suggests that achieving behavioural and health change across an entire community is a challenging goal that many programmes have failed to attain. Langley and Alsop (1996) and Langley and Simpson (2009) point out that the all-injury approach (all injuries, all settings) at local level promoted in Safe Community movement may not be an efficient and effective approach. Langley and Alsop (1996) write that greater caution should be exercised in promoting broad and multifaceted intervention programmes and attention should be paid to the substantial input of resources in these interventions by asking "What might have been the return if similar resources had been concentrated on one or two very specific issues (for example helmets for cyclists)". The emphasis should be on those measures that have been shown to reduce important injuries; safety behaviours like the use of cycle helmets and other impact measures such as changes to play-

ground equipment (Langley et al. 2009). An Australian evaluation of a community based injury prevention programme concluded that instead of large scale community wide interventions, fewer and more targeted interventions may be more effective, and to succeed greater community reach and organisational changes are important (Ozanne-Smith et al. 2002).

A Swedish study examined associations between infrastructure and local implementation of safety policies (Timpka et al. 2009). The study reported that in injury prevention and safety promotion programmes middle managers responsible for budgets at local public service offices found little incentive for cooperation across organisational boundaries. Similarly, there was little interest in building a shared infrastructure to support local safety promotion, e.g. by implementation of local injury surveillance systems. It was mainly the municipalities that needed the injury data in order to plan and implement preventive measures, while the collection and analysis of the data was the responsibility of the public health offices managed by county councils. The contradiction between the safety promotion management in the municipality and public health offices therefore predisposed towards a poor, or lacking, local infrastructure, diminishing interest in agreements concerning inter-agency sharing of surveillance data and integrated evaluations of interventions. The local level difficulties were identified to be associated with the separation from the national-level departments and agencies, and with differences in the geographical jurisdiction areas between the local offices that needed to collaborate. The silo structure of government organisation and assignment of resources, in Sweden, was found to be a barrier to collaborative action for safety at a community level. The researchers argue, that it may be overly optimistic *to take for granted* that different approaches to injury control can share infrastructure. Similarly, it may be unrealistic to presuppose that safety promotion can reach its potential in terms of injury rate reductions unless the critical infrastructure for this is in place. (Timpka et al. 2009.)

Researchers (Nilsen 2006; Spinks et al. 2009; Stevenson et al. 2004) suggest that there is a need to shift the objectives of large scale community-based injury prevention studies in the future. A greater recognition of the processes that enable a community to make its contribution is required (Simpson et al. 2003). Simpson (2003) argues that if success is dependent on achieving a meaningful reduction in injury rates in smaller communities, they are unlikely to succeed. The number of strategies and outputs for achieving change that could contribute to increasing safety need greater acknowledgement in future community programme evaluations. Critical attention should be paid to the development of community capacity and the context in which the projects are operating. (Simpson et al. 2003.) In addition to individual level risk factors, interventions to reduce the burden of injury in the population should address the relevant contextual factors responsible for the circumstances and events that can lead to injury, including the factors that are barriers and facilitators to prevention programmes. Evaluation can then be achieved by monitoring changes in prevalence of the identified factors, and consequent reductions in the injury of

interest. (McClure et al. 2010.) Data collection methods and indicators to assess and monitor a culture of safety, programme sustainability and long-term community involvement need to be developed (Towner et al. 2002). Mittelmark (1999, 17) highlights practical aspects about the feasibility of conducting research of sufficiently high scientific standards in the framework of the communitywide trial design. Obstacles to be solved in community based research are: small sample sizes, secular trends, small population level changes and the fact that wide scale community-based research programmes are expensive to conduct (Mittelmark 1999, 17 - 18).

3 Injury monitoring and surveillance

The purpose of this chapter is to summarise the body of knowledge related to injury monitoring and surveillance systems relevant for local injury prevention purposes. Scientific articles and text books on injury epidemiology and the scientific basis of injury prevention and control, as well as general public health surveillance text books, were reviewed. The main databases that were searched for published articles were PubMed and SafetyLit. The following search words and their combinations were used: injury/accident, surveillance/surveillance system, monitoring/monitoring system, data utilisation. The difficulty with the searches was that they found plenty of epidemiological studies but not studies on injury surveillance systems. Using terms community-based prevention, community-based intervention, or prevention gave more focused search results. The feature of "Find related articles" was used when an appropriate article was found. In addition, references in the retrieved articles were used to identify further papers related to the topic. In a few cases the authors of the articles were contacted for further information and some experts were contacted by phone or e-mail.

3.1 Public health surveillance and health monitoring

In 1968 the 21st World Health Assembly focused on the surveillance of communicable disease, applying the term 'surveillance' to the diseases themselves rather than to the monitoring of individuals. The discussions reflected the broadened concepts of epidemiologic surveillance including the proper dissemination of results to those with a need to know and particularly to those in a position to take action towards prevention and control. The discussion also addressed the application of surveillance to public health problems other than communicable diseases. Since that time, a wide variety of health events and behavioural risk factors have been placed under surveillance. In 1976, recognition of the breadth of these surveillance activities was made evident by the publication of a special issue of the International Journal of Epidemiology (1976: Vol. 5, No. 1:3-91) devoted to surveillance. (Thacker 1994, 6-7.)

Surveillance is defined as an ongoing information system that is inherently outcome oriented. Such outcomes include measures of the frequency of an illness or injury, the severity of the condition and the impact of the condition. (Horan et al. 2003; Laflamme et al. 1999; Thacker 1994). A surveillance system differs from health monitoring in its ambition and purpose. Public health surveillance is not only case detection, but also obtaining data on risk factors, protective factors, treatment, epidemiologic investigation, and follow-up. The methods of obtaining data include surveys, registers and targeted information systems to collect data on a specific issue. Accident investigations are important to obtain data on factors leading to acci-

dents and injuries. While existing data sets can be used for monitoring and for surveillance, they are not surveillance systems themselves (Teutsch 1994, 22). Surveillance is a larger process that requires analysis, interpretation and use of the data. These aspects are not components of most data systems. (Teutsch 2000, 21.) Data analysis resources and capacity are often limited in organisations participating in health promotion and injury prevention at a local level, thus alliances and co-operation between municipalities, research agencies and universities are seen as important by Ekman and her colleagues (2008).

The evidence that we have on health problems draw to a large extent on official statistics and surveys and are valuable for health and safety promotion, but a critical use of official data that takes full account of the manner in which they have been constructed is needed. Public health surveillance data are not facts in their own right, but are socially constructed (Tones et al. 2004, 53). The ways in which official data are constructed are influenced both by technical and ideological issues. Mikko Jauho (2007, 31-37) studied how tuberculosis prevention developed between 1880 and 1930 in Finland. The study demonstrated how knowledge of a health problem creates responsibilities for action and legitimises work practices. The approved epidemiological, bacteriological and immunological knowledge, together with social welfare statistics and social-hygiene information established categories of the severity of the tuberculosis problem. Thus knowledge defined tuberculosis into problem issues that society needed to address. This categorisation of the problem influenced the responsibilities and work practices in prevention. The defined problem areas became the targeted areas of public health actions and established the positions, roles and responsibilities of administrative segments and professions within the society towards securing the health of the population.

There are issues concerning the technicalities of data collection, particularly its representativeness and completeness, and the uncritical use of official statistical data is problematic (Kivivuori 2006). Official surveillance data will only include those who have come into contact with services, registered vital events or been included and participated in official surveys (Tones et al. 2004, 53-54). Kivivuori (2006) distinguishes between three types of inclusiveness. Statistical information systems ought to be evaluated according to whether they provide information that is socially, geographically or thematically inclusive. Regarding violence surveillance, socially inclusive data sources should capture violence data evenly through all socio-economic and population groups. Often surveys do not reach, for example, older men who are addicted to alcohol and among whom violence is more common than in the population in general. By geographically inclusive Kivivuori means data that covers different parts of the country or region and also different living environments. Problems may occur in country side regions where the population density is low. According to Kivivuori thematically inclusive data excludes no types of violence.

A distinction between surveillance data and data collected for epidemiological research ought to be made. Surveillance data can be used for epidemiological research. Also the use of surveillance data for the purpose of epidemiological research is generally thought to improve the quality of the surveillance data collected. However, surveillance should not be subordinated for the epidemiological research data needs. Surveillance differs from epidemiological research in many respects. Public health surveillance usually does not meet the definition of research because the purposes are not to contribute to knowledge that can be generalised, but rather to undertake prevention and control steps (Birkhead et al. 2000). In addition, the ongoing and action oriented nature of the data makes surveillance different from epidemiologic research. A surveillance system is part of public health practice and should guide and control the prevention measures (Laflamme et al. 1999).

The central purpose of a surveillance system is to provide data and information for prevention: to detect emerging hazards, to support decision makers in setting priorities and provide data for evaluating public health actions (Driscoll et al. 2004; Horan et al. 2003; Laflamme et al. 1999). Due to this close link, the organisations producing surveillance data should be linked to the officials responsible for the health and health promotion of the populations concerned (Thacker 1994,7). Auer and Andersson (2001) and Shipton and Stone (2008) argue that linking data to action at a local level is not a reality.

3.2 Injury surveillance

According to Robertson (1998, 49) the central purpose of injury surveillance is to monitor trends of particular types of injuries. But more detailed data on injuries can be used to target injury control measures to relevant circumstances and populations and to increase the effectiveness of resource allocation (Robertson 1998, 49).

There are areas where injury surveillance differ form the surveillance of other health conditions. Firstly, obtaining information on the accident circumstances and chain of events may be more important in injury surveillance than in health monitoring in general in order to understand how the injury incident occurred. The second departure between injury surveillance and the surveillance of other health conditions is in relation to the need for timely dissemination of data according to Mitchell (2008, 53). The requirement for timely and immediate reporting is not as critical as is in infectious disease, such as Legionnaires' disease. However, for some injuries, such as product-related injuries, the rapid dissemination of information can assist in preventing further injuries. The third area of difference between injury surveillance and other types of health surveillance is the identification of the agency responsible for injury prevention action. The agency responsible for injury prevention is not always entirely clear. While injuries are treated within the health systems, the prevention of injuries lie largely outside the jurisdiction of the health sector. (Mitchell 2008, 52-54.)

In high income countries several systems for surveillance and monitoring exist, and possibilities to create and start new ones for specific purposes are available. The growth and development of injury surveillance presents challenges, however. With more systems that can provide more data, there is, at the same time, a need for integration. Integration of information systems is a multidimensional issue encompassing data on risk factors and injury events, at local, national, and international levels, and including systems that are intended to serve not only public health but also clinical, administrative, and other functions. Injury monitoring in general faces the challenge of integration during a time of increasing capacity for electronic access to and transmission of information. (Horan et al. 2003.)

The number and variety of injury surveillance systems will most likely increase in the future and the means of cooperation between the data collectors, information providers and the local actors are needed. In order to use the data it is important to understand the definition of injury in each particular system. Many injury surveillance systems cover only a specific part of the injury problem. In addition, many systems are not population based or selective to the most severe injuries. For example, a surveillance system in a highly specialised children's hospital could receive the most severe injury patients from throughout the country. Most surveillance systems can provide data on the immediate consequences of accidents – death and injury, thus providing only a partial description of the true size of the injury problem. Often there are considerable long-term consequences that even sophisticated surveillance systems are not able to capture (Krug 2004).

From a comprehensive community-based injury prevention programme point of view, existing surveillance systems have their limitations and may have differential bias in the type and severity of the injuries they do identify (Driscoll et al. 2004). Mitchell and her colleagues (2008) argue that in Australia injury prevention policy and practice decisions rely on data restricted to fatalities and serious acute injuries with almost immediate injury outcomes. They write that the scope of national injury surveillance needs to be expanded to cover EDs nationwide and to ensure that no gaps in surveillance exist. They further propose that the validity of national injury data collections should be assessed to determine their accuracy for identifying national priorities.

Horan and Mallonee (2003) proposed that surveillance of injuries should be viewed as one component of the larger system of public health surveillance, whilst Langley (2004) recommends that efforts to develop comprehensive injury surveillance systems for *important* injuries should be undertaken. Kisser and his colleagues (2009) have pointed out the fragmented nature of injury surveillance systems by characterising injury surveillance as "an incomplete puzzle of data sources that only provide a notion of the complete picture but lacks important details". They argue that for the purpose of injury prevention general health statistics lack the necessary detailed information on the external causes of injuries. On the other hand, accident

reporting systems such as those operated by fire brigades, the police or labour inspectorates cover only a limited segment of injuries. (Kisser et al. 2009.)

However, Kisser and his colleagues (2009) propose that based on available sources, it is possible to reconstruct an almost complete and comprehensive picture of all injuries and in relation to settings where they occur as well as the severity of the outcome. The model presented by them utilises data from various data sources and is called a *Comprehensive view on injuries*. The comprehensive view on injuries model combines *horizontal data sources* with *vertical data sources* (Kisser et al. 2009). Horizontal data sources cover all types of injuries, e.g. cause of death statistics, statistics on disablement, hospital discharge and outpatient statistics and other incidence information collected via surveys. Vertical data sources, on the other hand, are sector based surveillance systems, such as data collection on school injuries, traffic accidents or occupational accidents. Thus it is of great importance to use various data sources simultaneously.

Injury surveillance systems are usually built by experts and researchers, and it is most likely that their full potential to increase the injury prevention capacities is not widely used. Surveillance has multiple purposes and several opportunities, some of which extend beyond the central purpose and could be even more important for local injury prevention practices. Surveillance and monitoring data are used as a means of persuasion and to raise awareness in a wider community of the need for countermeasures. Surveillance can build awareness and educate while community stakeholders and policy makers are participating in data collection or using the data. Proper dissemination of data communicates the relevance of injuries and injury prevention to individuals and agencies not traditionally or primarily dedicated to injury, motivating them for cooperation. Thus it is important to design surveillance systems for the use of a wider audience. (Schaechter et al. 2007.)

It has been suggested that too much attention has been paid on the mechanics of making surveillance systems run well, and too little attention on how the information is transferred to serve towards prevention, which is the ultimate goal and the justification for the existence of surveillance systems (Pless 2008). On the other hand, as pointed out by Finch (2008), whose specialty is in sports injury prevention and control, there are still notable injury sectors that lack proper surveillance data. Finch states that it is hard to see how the sports injury field will develop further without due attention to appropriate surveillance methodology. The lack of information from surveillance systems is associated with the non-existence and non-understanding of a specific injury problem. Unless the surveillance systems can provide information on the magnitude of school injuries, bicycle injuries, pedestrian slips and trips and the risk factors associated with these injuries, the true nature of the problem is not understood and effective counter measures cannot be constructed, argues Finch.

A relatively comprehensive population based surveillance system, that is often referred to, is the surveillance system in the Australian State of Victoria, which has a

population of over 4.5 million (Watson et al. 2000). The system covers the entire range of injury causes and all levels of severity. Data for the system is collected by various agencies on injury deaths, hospitalisations and ED attendances. The data are supplied to Monash University Accident Research Center, MUARC (Stokes et al. 2000). These data have been augmented with the addition of socio-economic status, estimations of injury costs through inclusion of years of life lost, quality adjusted life years and disability adjusted life years and estimations of resource costs to government (Stokes et al. 2005).

It is evident that the large injury surveillance system provides a number of opportunities at the state level as well as at a local level. These include the potential to apply evidence-based strategic planning and evaluation in injury research and prevention and even to forecast future injury trends (Stokes et al. 2005; Watson et al. 2000). The aforementioned surveillance system is a regional information system, however in Australia as a whole injury surveillance is limited almost entirely to tracking fatalities and serious acute injuries (Mitchell et al. 2008). To improve the foundations for nationwide injury prevention, researchers recommend priorities for injury surveillance, e.g. improving mortality and morbidity data collection, filling the gaps in existing surveillance systems to create a geographically inclusive system that covers all types of injuries, increasing the integration and accessibility of injury data through data warehousing and data linkages, and developing technical expertise in surveillance among researchers and data coders (Mitchell et al. 2008).

There has been considerable debate over the level of detail necessary in data collection, the appropriate indicators to guide injury prevention and setting priorities. Opinions on these matters are polarised. The balances between detailed enough/not detailed enough data and resources for surveillance versus resources for prevention are ongoing discussions among stakeholders when injury surveillance systems are being developed.

Some are of the opinion that the availability of a large collection of detailed and high quality case records, even on “minor injuries”, is necessary for injury prevention. McClure (1996) argues that “minor injuries” not requiring inpatient care account for many operations and that the health burden of these injuries is extensive at the population level. Thus the aggregate population burden, counting all injuries treated in walk-in clinics as well as those admitted in hospitals, is an important measure (McClure et al. 1996). In 2003 Wadman and colleagues exhibited a graphic depiction, using pyramids, of the burden of injuries in two states in the USA. They used encoded data from causes of death statistics, hospitalised patients and ED records. Their study lent credence to the notion that different causes of injury produce markedly different rates of death, hospitalisation and ED visits. As an example, motor vehicle crashes and falls produced pyramid shapes with a wide base suggesting that they have a significant cumulative effect on health care use and costs. (Wadman et al. 2003.)

Strong arguments against the detailed data collection of less severe injuries have been presented by Langley and colleagues (2004; 2009). They argue that the collection of detailed data concerning minor injuries leads to a threat that these injuries are emphasised in injury prevention and control, and withdrawing attention from severe injuries (Langley 2004; Simpson et al. 2003). Another argument against detailed data collection arises from the viewpoint of resource allocation. Langley (2004) writes that in allocating scarce resources one needs to prioritise the improvement of information on severe injuries, i.e. injuries that are a major threat to health, such as death or disability. For example, in several high-income countries suicide, as a cause of injury death, is equal to or greater than motor vehicle crashes. Few countries, however, have an ongoing process of collection, analysis, interpretation, and dissemination of surveillance data concerning suicides comparable to that developed in the same countries for motor vehicle traffic crashes. (Langley 2004.) However, confidentiality policies and privacy issues as well as national legislation affect the accessibility of data and information. Especially at the local level where the number of fatal or in-patient treated injury cases annually may be small, privacy issues are important. In Finland personal harm caused by traffic accidents are regularly published even for singular accidents and at a local level. However, in general accessibility to health related data in the form in which identity of the injured would be identifiable is strictly regulated.

The information needed, and the value of that information, is highly dependent on the stakeholder. The information needs at a ministerial level are different from those at a local level. Health policy makers and health administrators need to know the injury burden on regional/national health, whilst administrators and stakeholders in transport or workplace need specific and detailed information on risk factors related to specific settings and activities within the field of their responsibilities. Detailed information of traffic accidents within a municipality is important for traffic planners and detailed information on elderly falls is equally important for directors and care givers caring for the elderly. In the field of occupational safety near accident reporting is becoming more common.

The importance and value of the existence of injury data of outpatient care is noted in programme evaluations. Both mortality data and hospital discharge data could be used to evaluate changes in injury incidences. But these data have known limitations. They are insensitive to changes, where as surveillance systems which systematically capture outpatient data, with around ten times the number of cases as compared with inpatient data, are recommended for local level programme output evaluations. (Lyons et al. 2005; Spinks et al. 2004.) Already the early Safe Community programme evaluations in Sweden and Norway used data on medical care including outpatient data (Schelp et al. 1987; Ytterstad et al. 1995).

A Cochrane review (Spinks et al. 2005) pointed out the statistical power that outpatient data have. Hospital discharge registers are often convenient and less costly for evaluation purposes, they are objective but less reliable according to Spinks and

colleagues (2005). Kisser and his colleagues (2009) argue that hospital discharge registers reflect the time and region-specific way of organising health care, and discharge registers alone are not a reliable information source for injury morbidity surveillance. In recent years outpatient data has become more and more available for surveillance in high-income countries. Despite this fact only four communities, Falköping and Motala in Sweden, Harstad in Norway and the Shire of Bulla in Australia, out of 80 designated Safe Communities in 2004, were able to use local surveillance systems including outpatient data as their data source for programme output evaluation (Spinks et al. 2005).

Langley and Simpson (2009) propose that for small to medium size communities a better use of their limited resources would be to focus on measuring the effect of relevant risk factors for important injuries, such as alcohol impaired driving, bicycle helmet wearing or speeding. Since substantial efforts in injury prevention are put into promoting the use of safety devices, the consequent health behaviour changes should also be measured. Without having reliable trend data on safety behaviours such as helmet wearing, seat-belt usage or speeding, it is impossible to determine whether any observed declining trend is attributable to injury prevention efforts. (Langley 2004.)

According to Horan (2003) the systematic collection and use of data on risk factors, incidence, severity, outcomes, and costs has assisted practitioners and researchers in identifying populations at risk, implementing and evaluating prevention programs, and formulating and evaluating policy. Common view is that information necessary for injury surveillance should include information regarding the injured individual, the circumstances of the injury event, activity when injured and the injury outcome.

This study is about injury monitoring. The data needed for programme output evaluations is more extensive and data on injuries are only one fragment of the data. Nilsen (2006, 134-138) identified several knowledge gaps, and accordingly data gaps, in his study on the Safe Community studies. According to Nilsen (2006, 134-138), we lack (1) resource investment data, (2) programme exposure data, (3) data on extra community factors, (4) data on funding mechanisms, and (4) data to measure the many intangible resources e.g. organisation level resources, community level concepts like capacity, empowerment, participation, competence and readiness that affect community-based programmes. In addition, Nilsen argues, that often we also lack data on subjective dimension of safety and on injury determinants.

An outcome model by Nutbeam (2000, 5-9) presents a framework of measures of effectiveness. Different interventions produce different outcomes in the short and long-term and according to Nutbeam it is important to use a framework which helps define the outcomes associated with health promotion activity. He writes that in addition to outcome evaluation the process evaluation is needed for a more complete understanding of how and why something has happened. According to Nutbeam

both qualitative and quantitative data collected in observational and experimental studies is needed for the process evaluation.

Nutbeam lists alternative objectives that health promotion programmes may have and the outcome measures and possible indicators needed to assess the desired achievements. Measures of social outcomes include quality of life, functional independence and equity. Measures of health outcomes include reduced morbidity, disability and avoidable mortality. Measures of intermediate health outcomes, or modifiable determinants of health, include healthy life style measures such as physical activity or alcohol use, effective health service measures such as provision of preventive services and healthy environments measures such as restricted access to alcohol or safe physical environment. Health promotion outcome measures include health literacy measures such as health-related knowledge, attitudes and motivations, social action and influence measures such as community participation, public opinion or social norms and healthy public policy and organisational practice measures such as policy statements, resource allocation or organisational practices. Health promotion action measures include education, social mobilisation or advocacy measures. (Nutbeam 2000, 6.)

3.3 Information systems for monitoring injuries at a local level

At the beginning of the 21st century, several activities are expected to contribute to the evolution of public health surveillance and monitoring. The development of technology will continue to affect the practice of public health surveillance and a multi source public health surveillance and health information system can be developed (Thacker 2000). Since injury problems and trends vary between communities, relevant data are needed to identify and characterise community problems (Graitcer 1987). Such data has to be based on local cases, reflect local needs and to a large extent to be generated locally as well. Since public health and injury prevention draws data from multiple data sources, including data from different disciplines, the building of comprehensive information systems for monitoring requires understanding of different perspectives and skills to synthesise data from different sources (Rowitz 2009, 195). A Swedish study found that injury data recording was one of three key areas identified by stakeholders of the Safe Community programmes that needed to be further supported by computer-based information systems (Timpka et al. 2008).

An ideal information system for injury surveillance and monitoring at a local level is presented in the Figure 1. Injury surveillance in this ideal system includes possibilities to use several information systems and several information systems need to be considered together when addressing comprehensive injury surveillance at a local level. Dedicated surveillance systems exist for specific accident categories, such as traffic or occupational accidents. Dedicated surveillance systems are also

those extracted from larger information systems, such as injury surveillance data obtained from electronic patient registers.

Both local and national information systems that collect and process data on accidents and injuries can be used as components of this ideal injury surveillance system for injuries. Local information and national statistical systems can be considered as interconnected. Local information systems collect data for national statistical systems that can return data and information back to local information users. Thus information from the national systems can be components of local information systems. On the other hand, local information systems that exist independently, not being part of any national system, can be components of this ideal information system. Each information or surveillance system has its own unique characteristics. But they can also incorporate common characteristics. Thus the concept of a local information system for injury surveillance might encompass a hierarchy or nested relationship of several surveillance systems.

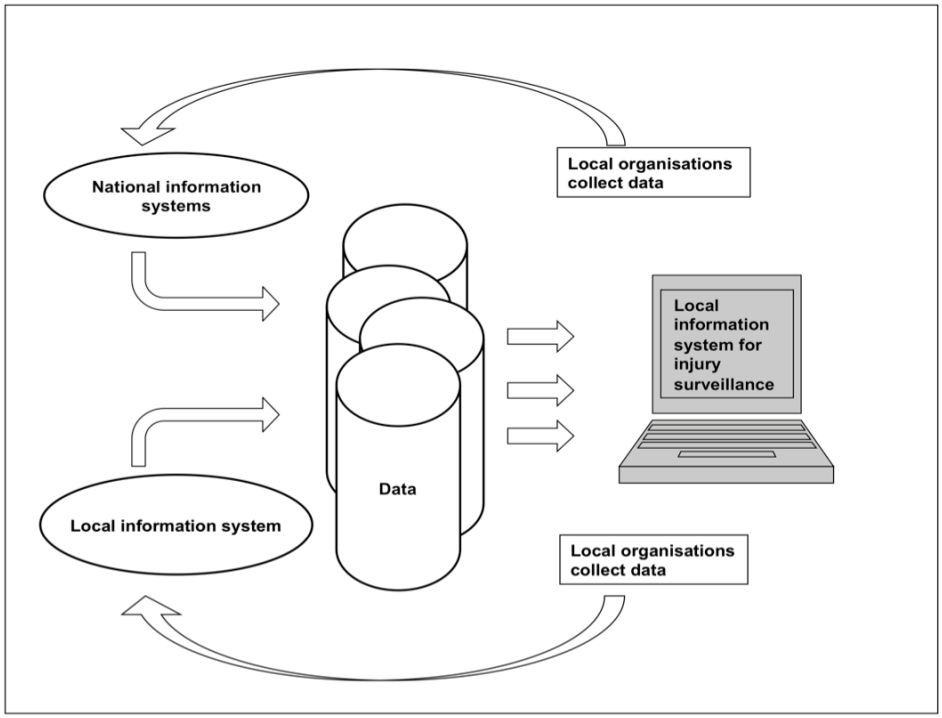

Figure 1: An information system for monitoring injuries

In addition to technical and software components, people and social systems are vital components of any information system. Norros and Kaasinen (2007; 2003) ar-

gue that technical systems ought to be studied as human-centred to solve problems related with technology. They highlight that human-machine interaction is too narrow an approach. Instead the use of technology ought to be studied in a wider environmental context and as part of everyday practice. The purpose of a local information system for injury surveillance and monitoring is to be an administrative tool for local public health and injury prevention leaders. Therefore, the local injury prevention practitioners, as end users of the data, and local data entrants in various organisations should be included as vital components of any local injury monitoring information system.

Dean (2000) argues that before the ideal public health surveillance system is in place several barriers have to be surmounted and only a few of them are technical. He details the barriers as follows: there is a profusion of computerised systems for inpatient and outpatient records, the barriers to establishing standardised output from computerised medical records are primarily administrative and political, there is a lack of recognition that information about patients is useful in public health; and a pervasive feeling among those in charge of data that their database must be clean before anyone else can use it. He writes: “Several kinds of mental shifts, as well as corresponding technical developments, will be necessary before computerised systems can be used to examine automatically a time slice of disease and injury records that originate in clinics and hospitals” (Dean 2000, 323).

Technological development will affect injury surveillance and monitoring. This in turn leads to new disciplines that the leaders, advocates and managers of public health, injury prevention and safety promotion should master. They need to understand the different perspectives of the various professions involved in the surveillance system and learn how to synthesise data from different sources. Information science, computer science, and computer technology are advancing and affecting the tools available for statistical analysis and information dissemination. (Rowitz 2009, 195.) However, Thacker (2000) argues that the critical challenge in public health surveillance continues to be the assurance of its usefulness. For this reason, he writes, we must regard surveillance as a scientific endeavour and maintain a rigorous evaluation of public health surveillance.

3.4 Medical care based injury surveillance systems

The term medical care based injury surveillance systems refers here to surveillance systems where data collection occurs during the admission, treatment and discharge while an injury patient is treated by a health care provider. Such systems could cover both inpatient and outpatient care. In order to be comprehensive data collection in both primary health care and specialised medical care is necessary in Finland and both public and private sectors ought to be included.

Medical care based data are considered to be among the most important data sources for monitoring injuries in local injury prevention activity (Annest et al.

2008; Ekman et al. 2008; Quigg et al. 2011). They cover all types of injuries that are severe and need to be treated by medical personnel. For injury monitoring, in addition to data on patient and injuries, ideally external causes of the injury and other accident related information will be coded and entered into electronic patient records. Medical care based injury surveillances systems may include the following injury specific information: injury diagnosis, external cause of injury, type of injury (home, sports, work etc.), place of occurrence (transport area, residential area, open nature etc.), type of activity at the time of injury (domestic work, play etc.), mechanism (physical blow, hit, fall, thermal effect etc.) and an injury severity code. Sometimes narrative text fields are used to gather information about the event resulting in presentation to a health care provider for treatment. The medical care based injury surveillance system could be an independent system or it could be formed by extracting injury information from the health care providers' databases.

3.4.1 Injury classification systems

Classifications used for injury surveillance in health care are based on the International Statistical Classification of Diseases and Related Health Problems (ICD) (WHO 2004), the International Classification of External Causes of Injury (ICECI) (ICECI coordination and maintenance group 2004) or the classification of external causes of injuries developed by the Nordic Medico-Statistical Committee (NOMESCO) (NOMESCO 1997). The 10th version of ICD classification has been used in Finland since 1996 (STAKES 1995). Injuries are classified by trauma and by external cause codes in the ICD classification. In principle, the ICD classification system is intended to make it possible to classify injuries into either self inflicted violence, other types of violence which could be interpersonal or on a mass scale or, and third, into unintentional, i.e. accidental injuries. Injuries may be classified according to their mechanism (e.g. fall, burn, intoxication, drowning), place of occurrence (e.g. traffic injury, school injury), activity (e.g. sports injury, work injury), intentionality (e.g. unintentional, intentional injury), location of trauma (e.g. head injury, knee injury), pathophysiology (e.g. fracture, open wound).

The ICECI classification used in the European Union's Injury Database (IDB) system provides a more detailed classification system for injuries than the ICD classification. The ICECI classification contains a hierarchical coding system for place of occurrence, mechanism of injury, activity while injured, athletics, sports and exercise as well as for products involved in the accident. The ICECI classification is based on the NOMESCO classification that was developed in cooperation between the Nordic Countries (Denmark, Sweden, Norway, Iceland and Finland) and is still in use in the Nordic countries except for Finland. It also provides more detailed classification tables for the mechanism of injury, place of occurrence and activity while injured than the ICD classification. In addition, the NOMESCO classification contains specific classification modules for Transport accident classifica-

tion, Vehicle accident classification, Occupational/Industrial classification, Sports Activities classification, Violence classification, Self inflicted injury classification and Product classification (products involved).

3.4.2 Nordic developments during the past decade

The forerunners of medically based injury surveillance systems and registers have been computerised trauma registers in the USA, established in the late 1960s, and from the early 1970s medical care based injury surveillance systems have emerged around the world (Lund 2004). The first local injury registers in the Nordic countries were established in Sweden, Norway and Denmark in the 1970s.

In Skaraborg county in Western Sweden the all-age-all-injury surveillance system was developed to improve the "general and specific knowledge of accidents entailing personal injuries in order to form the information basis for a local, municipality-based injury prevention programme" (Schelp et al. 1987). In January 1978, continuous registrations of all emergency visits at primary and secondary health care began in the area. The accident registration system in Skaraborg County covered both ambulatory and inpatient care, but excluded injuries for which only dental care was required. The system was operated as a routine procedure in the course of the regular work of the nursing staff. In addition, for research purposes, telephone interviews were carried out within four weeks of the accident in order to gain better knowledge of the accident circumstances, and an examination of death certificates and the Cause of Death Register was undertaken in order to include patients not admitted to hospital. In the Skaraborg project it was noted that there is a need to further develop the external cause classification coding and AIS severity scoring systems for application in outpatient care. (Schelp et al. 1987.)

In Denmark the first local actors to start local data collection were in the community of Odense. The Odense system inspired the development of the NOMESCO coding system. The current and mandatory registration system in Danish hospitals is based on NOMESCO coding. This National Patient Register has been operating since 1987 for hospital inpatient admissions, and in 1995 the system was extended to include patients treated at EDs. (Frimodt-Møller 2009.)

In Norway, Harstad and Trondheim were the first municipalities to collect comprehensive injury data for local preventive purposes. The data collection began in 1985 in hospitals and from 1992 it covered the primary health care as well. All injured persons treated either at Harstad hospital or in the primary care were recorded. The injury form was completed in the emergency room, partly by the patient, or an accompanying person, partly by the staff and partly by the intern. The information was coded according to the NOMESCO coding system by an injury secretary and fed into the computer system. (Ytterstad et al. 1995.)

A more recent Nordic example of a surveillance system is a two-step population based injury surveillance system implemented in the Oslo region. In the first step a

minimum data set on all injuries were obtained using routine data collection procedures within the medical care system. For the pilot project a sample of 17 General Practitioners and all accident and emergency clinics in public hospitals were to fulfill an electronic injury surveillance module integrated into electronic patient journals for each injured patient. Inpatient and mortality data were retrieved from national data sources. The accident and emergency clinics in private hospitals, occupational health practitioners and dental clinics were excluded from the data collection. (Lund et al. 2004.) In addition to the medical information collected from every patient, additional injury specific data, which included data on intent, place of occurrence, activity while injured and location where the injury occurred, were collected on a mandatory basis. Fields to be filled on a voluntary basis included severity, time of injury and a narrative. To fill in the electronic module took on an average one minute. In the second step an expanded data set is collected for a limited number of injuries. The second step involves sampling of specific injuries, injured persons or places for in-depth investigations during a defined period. Data collection in the second step is conducted by means of person to person interviews or a postal questionnaire specially designed for the targeted injury types. This data may be complemented by accident site investigations by injury experts. Two second step data collections have been reported from Oslo. The first one investigated serious occupational injuries and the second one investigated serious injury from the building and construction industry. (Lund et al. 2004.) A new National Injury Register has been established in all hospitals in Norway with a Minimum Data Set to be registered in the routine procedure for all in and outpatients. This was launched after several years of preparation. (Lund 2010.)

The surveillance system development that has taken place in the local and regional programmes has had an impact on national level monitoring and surveillance. In the other Nordic countries injury surveillance systems were developed in the context of large-scale local injury prevention programmes that were led by physicians with public health and research interests. Likewise in Finland, in the North Karelia project, the data collection and information available to support, evaluate and give feedback for the programme was comprehensive and detailed. The sources of information were national health registers and several population surveys concerning diagnosed diseases, symptoms, health behaviour, quality of life and subjective health (Puska 2009a). The monitoring and surveillance tools that were developed during the North Karelia project later became instruments for health and risk factor monitoring at the national level.

It is notable that, at the time when comprehensive, medical care based local injury surveillance systems were developed in Sweden, Norway and Denmark, no similar developments occurred in Finland. Even though community-based programmes on chronic diseases prevention were carried out in Finland in the 1980s, no similar programmes on injury prevention were implemented. Further, although there was a Finnish member in the working group that developed the NOMESCO classifi-

cation for accident monitoring, the classification was never translated into Finnish language, which differs substantially from the other Nordic languages.

Several hypotheses could be made as to why neither NOMESCO classification nor community-based injury prevention programmes were implemented in Finland, unlike in the other Nordic countries. One explanation could be the lack of passionate and ambitious injury prevention researchers in the field of Medicine in Finland at that time. In addition a lack of financial resources and other support from national bodies could explain the differences. The national authorities may also have prioritised other injury prevention approaches than community programmes at that time.

However, in the 1980s injury researchers in Finland attempted to press for change and proposed models for injury surveillance (Honkanen 1983). A review, an assessment of experiences of injury data collection and recommendation for continuous injury registration in medical care was published by Honkanen (1983). He recommended that Finland should establish a national centre that would have the responsibility for developing a comprehensive injury surveillance and monitoring system. He recommended that data for injury surveillance should be collected in health care. All hospitals inpatients' discharges and a 10% sample of outpatient clinics were recommended (Honkanen 1983). In 2002 a new proposal to develop injury surveillance in Finland was published (Rintanen 2002). Once more, adequate resources, the establishment of a responsible national centre for comprehensive injury monitoring, and data collection via health care organisations were recommended. The first trial for a continuous and comprehensive local, medical care based injury surveillance and registration began in Finland in June 2004 (Nurmi-Lüthje et al. 2007; Nurmi-Lüthje et al. 2008).

3.4.3 Data quality

The quality of surveillance data, i.e. that it captures all relevant cases and records them correctly into the information system, is even more important for small local settings than for settings where the population base is greater. Poor data quality and incompleteness of data, e.g. missing actual injury cases or incorrectly coded sets, have been noted to hinder the use of information on decision making regarding injury prevention interventions (Timpka et al. 2008). A small population size itself often requires the use of statistical techniques, such as summing up years and combining classes, or using larger regions instead of municipalities. Data treatment diminishes the informative value of the statistics. Poor coding of key injury variables impair the data even further. In addition small population density in large municipalities poses difficulties to forming an accurate picture of the injury situation.

A clear, precise and well-documented definition about what an injury entails is needed for each surveillance system (Driscoll et al. 2004; Laflamme et al. 1999; Langley 2004). The definition could include criteria for person, place, time, diagnosis and epidemiological features and could vary in different settings (Laflamme et al.

1999). If complications arising from surgical and medical care are included as injuries they will form a significant proportion of injuries. In New Zealand such complications formed 17% of new admission inpatients to public hospitals for treatment of injuries in 1999 (Langley 2004). If a well defined inclusion criterion does not exist it is difficult to assess how well the information system captures events of interest.

A variety of concepts are used in studies that evaluate how well the injury surveillance systems capture the injury events that they are supposed to. This complicates the process of summarising the results of studies on data quality of medical care based injury surveillance systems. The commonly used terms are presented below and in the following chapters those concepts used by authors of the original studies will be used. *Ascertainment* is defined by Stokes and his colleagues (2000) "as the proportion of actual cases recorded". *Drop out rate* is defined as injury cases that should be in the data, but are missing. *Sensitivity* is defined as "the ability to correctly detect all cases of true injury events that the data collection intended to detect" (Mitchell et al. 2009). *Specificity* is defined as "the ability to correctly detect all non-injury cases that the data collection should not have detected as injury cases" (Mitchell et al. 2009). *Data completeness* is defined as "the proportion of missing, or recorded as not known, other specified or unspecified for key injury variables" (Mitchell et al. 2009). *Bias* is "the level to which the data under or over emphasises cases by type, severity, or any other variable" (Stokes et al. 2000). *Representativeness* is defined as "the degree of bias" (Stokes et al. 2000).

In a surveillance system based on data collected from 25 Australian EDs the ascertainment was 82.5% (Stokes et al. 2000). The drop-out rate was on average 13% in a system in EDs in the Stockholm area (Alberts et al. 1991). Initial completion rates of over 90% were achieved in the first few months of a pilot phase, but settling back to 70-80%, in an emergency clinic of a children's hospital in Glasgow, Scotland (Shipton et al. 2008). In the Oslo accident and emergency clinic the completeness rate was 75%, but was raised to 95% by educational support from an appointed physician (Lund et al. 2004).

When comparing the drop out cases with the cases actually reported it has been found that injuries resulting in admissions, poisonings, and those presenting overnight were more likely to be missed (Macarthur et al. 1999), and during weekends the drop out rate has been reported to be bigger than on work days (Stokes et al. 2000). The drop out rate is significantly higher in general practice than in specialised health care in a Norwegian study (Lund et al. 2004).

Accuracy comprises both validity and bias, but is often operationalised as the concordance/agreement between the original codes and the recorded data (McKenzie et al. 2009). Data accuracy has been measured by comparing actual injury surveillance system codes with written descriptions of accidents and injuries in patient journals, or by collecting comparison data by expert interviews in the EDs and comparing this data with the registered injury data. Low accuracy, or a large number of missing data, has been reported for injury specific variables. Studies show large

numbers of missing data and frequent use of "unspecified" external cause codes in EDs (McKenzie et al. 2009; Stokes et al. 2000), large numbers of missing 'activity when injured' codes (Lund et al. 2004; Stokes et al. 2000; Watson et al. 2000) and large numbers of missing codes for 'place of occurrence' (Lund et al. 2004; Stokes et al. 2000; Watson et al. 2000).

A systematic review of the accuracy of external cause codes of injury in hospital records using ICD coding concluded that there still is a limited empirical basis to validate hospital discharge data, since only very limited research on the accuracy of external cause coding exists (McKenzie et al. 2009). The studies accepted for this systematic review were from Australia and New Zealand. The accuracy of external cause coding ranged from about 64%, when exact code agreement was examined, to about 85% when agreement on broader groups of codes was examined. The agreement of coding intent was 95%, for unintentional falls 86% and for motor vehicle traffic crashes 63-81%. Another Australian study on the validity of ED data found 91.9% agreement on intent and 79.2% agreement on mechanism, and 86.7% agreement on falls and 77.3% for self-harm (Gillam et al. 2007). In a Finnish study (Lunetta et al. 2008) the proportion of missing external cause codes in the Finnish hospital inpatient discharge register varied according to age, hospital district, type of hospital, duration of hospitalisation, and nature of injury. The inaccuracies diminish the usability of the data source differently according to the region of Finland.

A narrative is a special feature in some injury surveillance systems. A short description of the accident leading to an injury has been argued to be one of the key information fields in the system and often of greater utility than nominal data (Stokes et al. 2000). McKenzie and her colleagues (2010) write that the value that text data has in supplementing coded data is that narratives provide more specific information which enables case selection or provides circumstantial information. Multiple causation of an injury event makes it difficult to code all relevant elements associated with the occurrence that increase the possibility of the injury; a short narrative is thought to at least partially solve this problem. Manual review and coding approaches, text search methods, and statistical tools are utilised to extract data from narrative text, and narratives are used to identify specific injury types and add value to coded injury datasets (McKenzie et al. 2010). Stokes and colleagues (2000) evaluated the accuracy of the specific narrative data field collected into the Victorian Emergency Minimum Data set (VEMD) in Australia. According to this study the narratives that best fulfilled the descriptive validity test were those of accidental poisoning or drug overdoses. Rarely, in other events did the narrative provided give detailed data of what went wrong; such as product information or a history of the injury event.

The inaccuracies and low completeness rates in injury data sets collected during medical treatment have been proposed to be associated with a number of factors related to organisations, employees and work practices:

1. low priority given to injury surveillance among medical staff as compared to other tasks in emergency care (Liu et al. 2009), health-care providers may see no reason for external cause of injuries coding since care is not affected by these details (Annest et al. 2008), health care providers do not understand the importance of external cause of injuries coding for public health purposes (Annest et al. 2008),
2. work place culture and data policies (Stokes et al. 2000), no financial incentives to conduct external cause of injuries coding (Annest et al. 2008)
3. low willingness to participate in injury registration among GPs and in primary health care (Lund et al. 2004; Ross et al. 2003; Simpson et al. 2003)
4. disconnectedness between the data entry personnel and the data users (Shipton et al. 2008; Timpka et al. 2008),
5. the ratio of injury case load to total work load (Stokes et al. 2000),
6. surveillance performed parallel to regular clinical duties (Timpka et al. 2008),
7. staff limitations - not enough personnel (Liu et al. 2009),
8. capacity deficiencies and inadequate education of participants involved within the system (Liu et al. 2009; Lund et al. 2004; Macarthur et al. 1999),
9. coding experience, as low case rates were found to be associated with high error rates (Stokes et al. 2000),
10. high turnover of workers (Liu et al. 2009; Lund et al. 2004)

The inaccuracies and low completeness rates in injury data sets have also been proposed to be associated with factors related to surveillance system design, characteristics and technical solutions

1. manual, stand-alone and paper based systems (Liu et al. 2009),
2. deficiencies in software for electronic data entry (Timpka et al. 2008),
3. deficiencies in the software e.g. not providing enough space or designated fields for injury specific codes (Annest et al. 2008)
4. failure to recognise all variations of patient care process, the process of entering the clinic/hospital (Liu et al. 2009),
5. surveillance system design/failure to consider all entry points into the system (Macarthur et al. 1999)
6. data coding complicated due to a large number of available codes (Shipton et al. 2008)
7. use of codes such as ‘unspecified activity’ or ‘other specified activity’ (Watson et al. 2000).

3.4.4 Personnel requirements

Investments in personnel resources are needed to sustain a high quality and on-going injury surveillance system in EDs. Based on their experiences in Oslo, where a medically based injury surveillance system that collected a minimum data set was set up, Johan Lund and colleagues (2004) concluded that a crucial factor in the success is to have enough resources for continuous quality control and feedback to personnel involved in the registration of the data. It is necessary to have special personnel for continuously instructing and giving feedback at each registration site. In Oslo a central unit was established to run the surveillance system and a half-time project leader worked on implementing data collection, coordinating the actors involved, giving feedback and analysing the data. Furthermore, it was found that the position of a part-time (20%) physician in emergency clinics was vital to educate and give feedback for other physicians. This arrangement increased the completeness of the surveillance data in the accident and emergency clinic from 75% to 95%. With these personnel investments, and with the ability to register injury data during the medical care routine in various clinics around Oslo, information on 48 200 visits by injured persons were registered over one year. Shipton and Stone (2008) reported that a part time data clerk was sufficient to process injury surveillance data in a hospital that provided care for 10 000 – 15 000 injured children per year.

Continuous education of personnel who enter injury data into the registers and databases in hospitals and EDs in primary health care or specialised medical care is seen as one of the most important factors to keeping up motivation and data quality (Gillam et al. 2007; Liu et al. 2009; Lund et al. 2004; Macarthur et al. 1999; Timpka et al. 2008). Macarthur (1999) argues that an identifiable proponent who actively encourages data collection and is available for problem solving supports data collection in EDs. To understand the logic and codes of the classifications, the concept of an injury and injury causation are crucial. It has been reported that the training of often overworked ED staff and rotating trainee physicians is a particular challenge, requiring much time and resourcefulness (Lund et al. 2004; Shipton et al. 2008).

The mismatch of data collection and data utilisation, with the emphasis often put on data collection instead of the allocation of resources for data analysis, has been reported to disintegrate the process of establishing a surveillance system (Shipton et al. 2008). Based on the experiences of an injury surveillance system in a large children's hospital in Scotland, Shipton and Stone (2008) suggest that injury surveillance requires three supporting posts: an ED staff member, a data analyst, and someone with responsibility for developing and/or lobbying for the implementation of preventive measures.

3.4.5 The role of electronic patient journals

A sustainable, on-going injury surveillance system that collects data on all injury patients during medical treatment is most likely to be an electronic information sys-

tem and very likely to be integrated as part of an electronic patient journal in Finland. Thus it is important to understand the determinants associated with the development of a medical care based injury surveillance system as an electronic patient journal modification process. It has been reported that continuous injury data collection has been ended due to information system modifications (Simpson et al. 2003). Berg (2001) argues that changes in electronic patient journals should be observed and managed as an organisational change process, and implementation should be conceived as organisational development, since the information system is intended to change the organisation's work practices. Healthcare organisations are complex and the outcome of implementation is therefore proposed to be difficult to predict in advance (Berg 2001; Greenhalgh et al. 2004). In addition, situation-specific factors affect implementation and the outcome of the implementation processes (Berg 2001; Greenhalgh et al. 2004).

The implementation of a patient care information system change is a two-way process; there is a deep interrelation of technical and social aspects. Renewal of technology will most likely affect the distribution and content of work tasks, change information flows, and affect the visibility of these tasks and information flows. It will also change the relationships between staff. (Berg 2001.) Greenhalgh and her research group (2008) performed an evaluation study of the early adopter sites for the shared electronic patient record in England. They found that the process of introducing new technology was heavily influenced at the micro-level by the material properties of the technology, people's attitudes and concerns, and interpersonal influence; at the meso-level by organisational antecedents, readiness and operational aspects of implementation; and at the macro-level by institutional and socio-political forces. According to Greenhalgh and colleagues (2008) these multiple levels shape, enable and constrain the introduction of technology supported innovations in clinical care.

A large number of empirical studies on implementation and modification of electronic patient journals exist. Greenhalgh and colleagues presented a conceptual model of diffusion of innovations in service organisations in 2004. Their model is a synthesis of theoretical and empirical findings based on a systematic review. Later on they (2008) used the framework as an analytical tool in the study that explored the introduction of the shared electronic patient record in England. Greenhalgh and her colleagues' (2004) model of diffusion of innovations in service organisations presents a continuum where at the one end the spread of innovation is labelled "make it happen" and at the other end "let it happen". Planned dissemination programmes are distinguished from the "good ideas" spread of innovations. Most diffusion research addresses developed innovations, e.g. technologies developed in formal research groups, and their planned dissemination. The main mechanism of spread in planned dissemination is centrally driven and controlled. In "good ideas" dissemination innovation spreads informally and in a largely uncontrolled way. (Greenhalgh et al. 2004.)

Introduction and implementation of an information system to register injuries in health care organisations can be seen as a planned innovation spread. Since injury data collection most likely will be integrated into the information system of electronic patient journals in Finland, the Greenhalgh and colleagues' framework and the results of their study on the introduction of shared electronic patient record in England may assist and thus are valuable in trying to understand the implementation of injury registration. They have identified the below presented components of the diffusion of the innovation in health services (Greenhalgh et al. 2004; Greenhalgh et al. 2008):

Material properties of the technology. To be successfully and widely adopted, a technology must include key functionality and work smoothly and efficiently under real conditions of use.

Attributes of the technology as an innovation. To be successfully and widely adopted, a technology must be seen by potential adopters as having a relative advantage - that is, clear benefits over existing technologies. Simplicity and compatibility with existing values and ways of working, trialability so that the technology can be tried out on a limited basis "without obligation", observability so that benefits can be seen directly and potential for reinvention so that capacity for users to customise and adapt the technology will increase the possibility of successful implementation.

Concerns of potential adopters. Adoption is a process, not a one-off event, and is influenced by concerns, including concerns before adoption: what are the innovation's properties and potential benefits? or what will it cost me?; during early use: how do I make it work?, when and how should I use it?; and during established use: how can I alter or improve it?

Communication and influence. A person's decision to adopt an innovation is influenced by mass media, including press and mail shots, which can raise awareness. The decision is also influenced by interpersonal communication and relations. Champions of an innovation and opinion leaders can change people's attitudes towards adoption.

Organisational antecedents for innovation. Organisations may be more or less innovative. Differences are explained by several factors: absorptive capacity for new knowledge, leadership and management, risk taking climate, effective data capture systems and slack resources.

Organisational readiness for innovation. An organisation must be "ready" for a specific innovation. Readiness is influenced and associated with innovation-system fit, tension for change, balance between supporters and opponents.

The implementation and routinising of a process. Implementing a complex innovation, and making sure it becomes business as usual, is a

highly non-linear process, typically characterised by shocks and setbacks. Critical success factors include an appropriate change model, good project management, autonomy of frontline teams, human resource factors, especially the selection, retention, continuity, and training of staff, and alignment between new and old routines.

Linkage. Innovation is more likely when there is early and ongoing dialogue between the developers of the innovation, the change agents charged with promoting its adoption, and the end users and communication within the organisation and between similar organisations.

The wider environment. Innovation in organisations is more likely when a "following policy wind", a conducive socio-political climate, and specific incentives and mandates at national level are present.

3.5 Other data sources

In addition to medical care based data, causes of death statistics are sometimes used in large-scale community-based injury prevention programmes. The validity and reliability of data depend critically on how accurately death certification measures the causes of death at the population level (Lahti 2005). The accuracy of death certification, in turn, relies on the quality of postmortem investigations, the quality of data compiled for each death and the coding procedures during the registration process (Lahti et al. 2001). Together with medical history, clinical information and investigations into the circumstances of death, an autopsy represents the best source of information for determining the cause of death. The autopsy rate is high in Finland, but postmortem autopsies vary by age group (Lunetta et al. 2007). Among the elderly medicolegal autopsy rates are lower than among younger people (Lunetta et al. 2007; Lyons et al. 2005). The accuracy of injuries in death certificates may also be biased among the elderly since medical doctors often fail to report injury as a contributing cause of death when an elderly person's death occurs in a hospital (Betz et al. 2008).

Traffic accident statistics based either on police records or on insurance claims are available in most developed countries. The major and well known limitation of traffic accident statistics is that they do not provide reliable information on the occurrence of non-fatal pedestrian, bicycle, moped and motorcycle accidents. Comparison of ED data with data from Official Statistics of Finland (based on police reports) show that less than 35% of two-wheeler accidents are recorded in official statistics (Airaksinen 2008).

Occupational accident statistics in Finland are based on insurance claims information. Occupational accidents which are entitled to compensation form the data since the compensation claim is the statistical unit for the official occupational accident statistics (OSF 2012b). Harmonisation of occupational accident data collection

in the European Union has taken place. The European Statistics on Accidents at Work (ESAW) classification is an EU standard (FAII 2002).

Surveys, in addition to registers, are used to collect data on injuries. The major shortcomings of national surveys are that they provide little information for each municipality, they are medically less accurate and that to estimate population burden of injuries by surveys, instead of ED based surveillance data, is less cost-effective (Petridou et al. 2004). Surveys create different accuracy and reliability concerns than data retrieved from registers. One of the concerns is related to how accurately people report accidents and injuries. The accuracy of injury data based on surveys is affected by recall bias (Jenkins et al. 2002; Petridou et al. 2004). For the month closest to the survey interview, the incidence rate is highest and it declines the more months the incident is remote from the interview (Petridou et al. 2004). If the recall period is greater than two months, the injury rates are likely to be significantly underestimated (Jenkins et al. 2002). In addition to recall bias, people may not report on unpleasant events such as accidents and injuries often are.

Another obvious limitation of survey methods is participation bias, which is related to getting a representative sample of the target group. The low response rate in general is a characteristic shared by many household surveys. In addition surveys intended to give true population estimates, may fail to reach all population groups equally, whereas hospital-based data can better capture information on all population groups.

Surveys also lead to different results than hospital data. The two different data collection methods lead to different distributions of persons injured; differences in age and sex distribution, the most frequent types of injury, place of accident and frequency of severe injuries have been reported (Bardehle et al. 2002; Petridou et al. 2004). Population surveys capture injuries not found in administrative health based registers. Mitchell and her colleagues (Mitchell et al. 2010) argue that health registers based on hospital admissions will grossly underestimate the incidence of sports injuries because few such injuries require acute medical care in a hospital setting.

Population surveys on the other hand could be useful for the generation of exposure patterns to various factors that may play a role in risk (Petridou et al. 2004). Surveys can collect information on safety practices, risk behaviour and safety attitudes. Surveys may also be a necessity to estimate prevalence and incidence of injuries not found in registers (Jenkins et al. 2002).

3.6 Utilisation of data and information

Barry Pless (2008) questioned the value of surveillance systems and information dissemination to “those who need to know” unless there are mechanisms, organisations and practitioners inclined and equipped to take action on the findings. Pless sees the application of the data for prevention as the ultimate test of a surveillance system’s value and observes that “surveillance requires a recipient of the informa-

tion who has the mandate, resources, and determination to take appropriate action" (Pless 2008, 222). Local data have power and a stimulating effect on local health promotion, but to have relevance for local practitioners, and for the population in the region, the statistics should have immediacy and concern the owning community (Ashton et al. 1988, 96). For example, aboriginal communities in Canada (Auer et al. 2001) and Australia (Heslop 2002) found that available information from large, centralised databases was of little relevance to their local needs (Driscoll et al. 2004). Another report (from Florida, Miami—Dade County), on the contrary, stated that using population based data from the state wide injury surveillance system that was mandated by the state was able to provide representative data for the region and which was considered as useful in engaging additional partners and resources (Schaechter et al. 2007).

A study on using local injury surveillance data for community based injury prevention found differences in data collection objectives between the WHO designated Safe Communities in Scandinavia and the communities belonging into the Canadian Safe Community Foundation's network (Nilsen et al. 2007). The major reasons Scandinavian programmes collect local injury surveillance data were to provide an overall picture of the injury situation and to monitor/study trends over time. In contrast, for the Canadian programmes the most important uses for the data were to identify different types of risk categories, to provide an overall picture of the injury situation and to provide a basis for decision-making concerning which interventions to undertake. The use of local injury data for evaluating or assessing programme results rated the lowest for both the Scandinavian and the Canadian programmes. According to the authors, the findings suggest that the Canadian programmes approach injury prevention more scientifically than the Scandinavian WHO-designated Safe Community programmes, by making greater use of injury surveillance for assessment and integration into prevention strategies and measures. (Nilsen et al. 2007.)

The application of surveillance data from health care is not a one directional process. A regular flow of information from surveillance system to policy-makers and staff about local injury hazards is a prerequisite for integration of surveillance information and safety programmes into the municipality's routines. Thus information management is an area where informal and ad hoc routines should be replaced with formalised routines. (Nordqvist et al. 2009.)

The role of public media is emphasised in community based programmes. Unlike in organisations, where inter-organisational communication can be used for information exchange and to activate employees, in community programmes public media need to be used extensively. The function of media use is not only to inform the residents and local politicians, but also importantly to achieve the desired bottom-up perspective and encourage community involvement. In the community programmes it is important to create and maintain this self-enforcing loop between residents and media. (Nordqvist et al. 2009.)

The ease of access, interpretation and use of the data is related to injury registers, IT systems, professional and other personal competences and factors related to organisations. Factors related to injury registers, such as incompleteness and time lag of injury registrations systems (Timpka et al. 2008) or poor quality of the data (Langley et al. 2007), hinder the use of the data for action. Time and information overload are problems that public health nurses report as barriers to accessing information (Revere et al. 2007). Jackson and colleagues (2007) and Nilsen with his colleagues (2007) argue that data delivery formats are important. In addition to databases and printed materials, informal networks, educational study days, presentations and experiences gained in the injury prevention practices are important for public health nurses and social care workers.

Auer and Andersson (2001) argue that the locus of control of injury surveillance systems resides primarily with experts under the jurisdiction and control of designated authorities. Local practitioners' viewpoints are missed when local data sources are developed to support local activities in reducing the number of injuries. Auer and Andersson state that for the surveillance system to have cultural relevance, the locus of control must be defined by the population of interest at the community level. This creates demands on the technical solutions of surveillance systems. The systems must be flexible in order to be able to respond local needs.

3.7 Injury surveillance guidelines and evaluation frameworks

Distinct injury surveillance systems form the basis of injury monitoring. The purpose of guidelines and evaluation frameworks are to ensure that problems of public health importance are monitored efficiently and effectively (CDC 2001). According to the WHO and CDC important aspects of surveillance systems are: simplicity, flexibility, acceptability, reliability, validity of data, utility, sustainability, and timelines. Security and confidentiality are other important features. (CDC 2001; Holder et al. 2001.) A reliable surveillance system should detect all injury events within the relevant population and exclude non-injury events, such as back pain that results from spinal deterioration (CDC 2001). A flexible system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds (CDC 2001). The notion of the demands on flexibility, allowing the addition or modification of data elements is increasing at a local level (Auer et al. 2001; Lund et al. 2004; Timpka et al. 2008). The surveillance system will only work if people are willing to participate in it, thus the acceptability of the system by the people involved is included in the guidelines (CDC 2001). An assessment of the usefulness of a system should also consider data quality attributes, objectives of the system and the system's effect on policy decisions and injury control programmes (CDC 2001).

Mitchell, Williamson and O'Connor (2009) presented a detailed and structured evaluation framework for injury surveillance systems. They recommend that data

quality and both operational and practical characteristics need to be included in an injury surveillance system evaluation. Their evaluation framework is based on an extensive literature review and expert opinion. Based on their inquiry they recommend the elements for injury surveillance system evaluation presented below (Table 2).

Table 2: Characteristics of the evaluation framework for injury surveillance systems and the definitions of characteristics. (Mitchell et al. 2009)

Data quality characteristics	Data completeness	Data completeness will refer to an assessment of the proportion of: missing, not known, 'other specified' data recoded for key characteristics of the injured population.
	Sensitivity	Sensitivity will refer to the ability to correctly detect all cases of true injury events that the data collection intended to detect in the target population.
	Specificity	Specificity will refer to the ability to correctly detect all non-injury cases that the data collection should not have detected as injury cases in the target population.
	Positive predictive value	The PPV will refer to the number of correctly identified true injury cases divided by the total number of cases that are identified (correctly and incorrectly) as an injury case from the target population.
	Representativeness	Representativeness will refer to the ability of the data collection to provide an accurate representation of the distribution of key characteristics of the injured population in a sample of the target population.
Operational characteristics	Purpose and objectives	The purpose of the injury surveillance system, the reason why the system exists, and the objectives of the injury surveillance system, what the information from the system is used for, should be described.
	Data collection process	The method of data collection for an injury surveillance system and the number of steps involved in data collection should be examined using a data collection flow chart.

	Case definition	The injury case definition adopted by an injury surveillance system to identify cases should be described.
	Timeliness	Timeliness will refer to the time taken to accomplish each of the three surveillance phases of: data collection, data analysis and interpretation, and dissemination.
	Uniform classification systems	The classification system(s) used to record information in the injury surveillance system for variables in the WHO's core minimum and optimal data sets for injury surveillance should be identified.
	Quality control measures	The quality control measures regularly utilised by the agency responsible for the injury surveillance system should be identified.
	Confidentiality and privacy	The methods by which an individual's information in the injury surveillance system is safe guarded against disclosure should be described.
	System security	The data access requirements (e.g. password protection) that safe guard against the disclosure of confidential information should be described.
Practical characteristics	Data accessibility	The method by which potential data users access data from the injury surveillance system should be reported.
	Usefulness	Usefulness will refer to the ability to contribute to the identification of potential key areas for preventive action in terms of the ability to: (a) identify new and/or emerging injury mechanisms, (b) monitor injury trends over time, and (c) describe key characteristics of the injured population.
	Data analysis	The routine data analyses using data from the injury surveillance system by the agency responsible for the surveillance system should be described.
	Guidance material to aid data interpretation	The availability of guidance material on the interpretation of data from the injury surveillance system should be described.

4 Summary of the literature reviews from the perspective of this study

The aim of this study is to investigate injury surveillance and monitoring in order to advance injury prevention at the local level. This chapter is a summary of the literature reviews for the four conducted empirical studies: 1) Local view points on injury monitoring, 2) injury data collection in EDs, 3) existing national data sources and 4) policy recommendations to improve injury surveillance. Public health surveillance is defined as an on-going information system and inherently outcome oriented, focused on various outcomes including measures of the frequency of an illness or injury, the severity of the condition and the impact of the condition (Horan et al. 2003; Laflamme et al. 1999; Thacker 1994). The central purpose of a surveillance system is to provide data and information for prevention: to detect emerging hazards, to support decision makers in setting priorities and provide data for evaluating public health actions (Driscoll et al. 2004; Horan et al. 2003; Laflamme et al. 1999). Robertson (1998, 49) argues that the central purpose of injury surveillance is to monitor trends of particular types of injuries. But in community programmes the purpose of surveillance data extends into areas of advocacy and informing the general public in order to achieve the desired bottom-up perspective and community involvement. A monitoring system differs from a surveillance system in its ambition and purpose. Public health surveillance is not only case detection but also obtaining data on risk factors, treatment, epidemiologic investigation, and follow-up. Public health surveillance also differs from epidemiological research. Surveillance usually does not meet the definition of research because the purposes are not to contribute to knowledge that can be generalised, but rather to undertake prevention and control steps (Birkhead et al. 2000). The ongoing and action oriented nature of the data makes surveillance different from epidemiologic research.

While existing data sets can be used for surveillance and monitoring, they are not surveillance systems themselves. (Teutsch 1994, 22.) Surveillance is a larger process that requires analysis, interpretation and use of the data (Teutsch 2000, 21). The way information from injury surveillance systems are proposed to be available and used for promotive and preventive practices are not a predominant reality. There is a wide gap between the ideal and the prevailing practice (Nilsen et al. 2007; Spinks et al. 2005). Injury prevention practitioners lack the basic information for planning and to evaluate outcomes (Holder et al. 2001; Krug 2004; Mulder 2001; Nilsen et al. 2007; Spinks et al. 2005). In addition community-based injury prevention programme ev-

aluations report difficulties in developing sustainable injury surveillance systems (Simpson et al. 2003; Spinks et al. 2005).

Local viewpoints. Researchers argue that data collected at local level does not adequately reach those who need the data (Shipton et al. 2008; Timpka et al. 2008). This further affects the motivation to collect injury data into defined injury registration systems (Shipton et al. 2008). Further, large-size national information systems are non-modifiable at a local level, responding poorly to local information needs (Auer et al. 2001; Lund et al. 2004; Timpka et al. 2008).

Data needs of local injury prevention practitioners are poorly understood and national level data sources do not provide the needed data (Auer et al. 2001; Driscoll et al. 2004). According to several researchers data needs for injury prevention, and especially for scientific programme evaluation are much greater than the current data sources can provide (Auer et al. 2001; Krug 2004; Nilsen 2006, 134-138). Schaechter and colleagues (2007) argue that as community programming and coalition building develops the demand on the surveillance systems changes. Partners desire a more comprehensive and population based system. Quigg and colleagues (2011) developed a detailed data collection on violent occurrences and a data sharing system as part of a comprehensive injury surveillance system in England. This data was used to support violence prevention. They found greater reductions in the area of intentional injuries compared to unintentional injuries and concluded that their findings support associations between data sharing and reductions in violence identified earlier by Florence and colleagues (2011). In general time lag and incompleteness of data have been identified as factors which decrease the usability of available data (Timpka et al. 2008).

Data seeking behaviour among nurses and social workers may require other forms of data dissemination than electronic databases and reports. Informal networks, educational study days, presentations and experiences gained in the injury prevention practices seem to be important for public health nurses and social care workers (Jackson et al. 2007). Time and information overload are problems that public health nurses report as barriers to accessing information (Revere et al. 2007).

Surveillance systems have other functions beyond the central purposes. The design of open information dissemination systems could engage additional partners and resources and increase the willingness to participate in injury prevention (Schaechter et al. 2007). They also educate staff while participating in injury data collection (Schaechter et al. 2007). It has been proposed by Nordquist and colleagues (2009) that a regular flow of information to policy-makers and staff about the injury prevention activities and local injury hazards is a prerequisite for integration of safety programmes into the municipality's routines.

Injury data collection in emergency departments. A strong alignment among injury prevention experts is that health based data is the best data source for injury surveillance since it captures all types of injuries (Ekman et al. 2008; Lund et al. 2004). Detailed injury data collections in EDs have been demonstrated to be associ-

ated with lower incidence rates due to violence (Quigg et al. 2011) and increased resources for injury prevention activity (Schaechter et al. 2007). However, health care organisations have demonstrated difficulties in initiating and sustain injury registration (Simpson et al. 2003). Injury registration does not fit in to work practices and causes a lack of motivation to register minor injuries among GPs (Ross et al. 2003) and in primary care (Lund et al. 2004). There is a lack of motivation since data for prevention is not important for care (Annest et al. 2008). Other factors are a lack of intra-organisational support (Shipton et al. 2008) and co-operation with the wider environment in sharing the data for prevention (Shipton et al. 2008), lack of personnel resources (2008; Lund et al. 2004; Shipton et al. 2008) and competencies (Horan et al. 2003; Lund et al. 2004), and deficiencies in software and technical properties used in injury registration (Annest et al. 2008; Timpka et al. 2008).

One common concern is: how to gain and sustain a good completeness rate. Stoekes and colleagues (2000) found that the completeness rate of ED data is lower during the evenings and weekends than at other times. It has also been demonstrated that the completeness rate is lower in primary health care than in specialised medical care (Lund et al. 2004) and decreases as the time from the initiation of a specific injury prevention programme elapses (Lund et al. 2004; Shipton et al. 2008). Injuries resulting in admissions or poisonings are more likely to be missed in injury records (Macarthur et al. 1999). Educational support could sustain and improve the completeness rate of injury records (Lund et al. 2004).

Identified organisational obstacles and barriers associated with data inaccuracies include work place culture, the low priority given to injury surveillance among medical staff (Liu et al. 2009; Stokes et al. 2000), the high turnover of workers and shortages of staff (Liu et al. 2009). Furthermore, low numbers of injury patients do not allow those collecting the data to gain experience and thus may lead to high error rates (Stokes et al. 2000). In addition work practices where surveillance duties are performed in parallel with clinical duties have been identified to be associated with data inaccuracies (Stokes et al. 2000). The identified supportive factors to improve data quality are continuous education (Lund et al. 2004) and regular and automatic quality assurance. It has been proposed that extra organisational support received from regional and national organisations could affect the completeness rate of injury registration in hospitals and emergency clinics (Annest et al. 2008).

Barriers associated with software include deficiencies in electronic data entry (Timpka et al. 2008). The extensive number of available external cause codes in routine injury registration has been identified as a barrier (Shipton et al. 2008). At the system level the failure to recognise all variations of patient care processes (Liu et al. 2009) and to consider all entry points into the system (Macarthur et al. 1999) have also been associated with data inaccuracies. Several kinds of mental shifts and corresponding technical developments are needed before computerised systems can be used to examine automatically injury records that originate from clinics and hospitals (Annest et al. 2008; Dean 2000).

Existing national data sources. Progress in injury surveillance and monitoring can be enhanced by developing the contents and by systematic approaches to accessing and using the existing data sources (Florence et al. 2011; Horan et al. 2003). The fragmented nature of existing injury information into various data sources (Kisser et al. 2009) and the challenge of integration during the present time of increased capacity for electronic access to and transmission of information is typical for injury surveillance (Horan et al. 2003). Many of the data sources collecting information on injuries are not representative (Mitchell et al. 2008). Yet Kisser and colleagues (2009) propose that an almost complete picture of injuries could be constructed by using existing data sources.

For medical treatment the medical information in the patient journals in hospitals and EDs are important but for prevention the injury specific information on external causes and circumstances are needed. Research point out data quality problems related to data completeness and accuracy. The large number of missing data among injury specific variables of external cause of injuries (Stokes et al. 2000), and activity or place of occurrence (Lund et al. 2004; Stokes et al. 2000; Watson et al. 2000), are identified problems in medical care based data sources. Poor data quality has been argued to be associated with a lack of dialogue between data entrants and those responsible for prevention (Shipton et al. 2008). In addition barriers to establishing standardised output from computerised medical records have been observed (Dean 2000).

Policy recommendations to improve injury surveillance. Adequate surveillance data is a prerequisite in local communities for high standard injury prevention activity. National policies can support the local communities to enhance injury monitoring even though only partial implementation of policy recommendations is commonly reported. An inventory of Australian recommendations on injury surveillance demonstrated that national policies and strategies to reduce the burden of injury have included 22 recommendations on surveillance since 1986, only three of which had been completely implemented by 2008 (Mitchell et al. 2008). The completed recommendations were to “Introduce a national electronic data collection system for coronial data”, to advance injury data collection systems by “establishing a national coronial information system” and to “implement a ‘place of activity’ code for routine hospital morbidity data collections and for coronial data recording systems so that work-related and sport-related injury can be identified” (Mitchell et al. 2008, 406).

5 Aims and questions

This study aims to increase understanding about opportunities, obstacles and barriers when in pursuit of improving the information related to injury surveillance and monitoring for local injury prevention activity in the Finnish context. The goal of the study is to provide results that have practical value for decision makers, managers and practitioners at the local, regional and national levels. To achieve this aim the research questions presented below will be addressed in four interrelated substudies.

The first substudy. The aim of the first substudy is to clarify and increase understanding of local viewpoints on injury surveillance and monitoring data in Finland. The research questions are:

1. What are the specific information needs and justifications for information requests required for prevention as expressed by local practitioners?
2. What injury information is commonly used at the local level?
3. What are the obstacles and barriers related to injury data collection and data seeking activity at the local level?
4. What motivates local practitioners to collect injury surveillance data?

The second substudy. The aim of the second substudy is to increase knowledge on factors associated with the process of developing ED injury data collection in the Finnish context. The research questions are:

1. What organisation, manager, leadership, employee and technology related factors are associated with the process of initiating injury registration in EDs?
2. Which factors support the process and predict a desired outcome?
3. Which factors contribute to the degradation of the process and predict obstacles?

The third substudy. Since progress in injury surveillance and monitoring can also be fostered by developing systematic approaches to access and use of the existing data (Horan et al. 2003), the third substudy investigates such data sources in Finland and the aim is to increase knowledge of the possibilities related to existing data sources. The research questions are:

1. What injury surveillance and monitoring data sources exist in Finland?
2. What is the value of existing data sources for injury surveillance and monitoring to support prevention at a local level?
3. How does the data quality, operational and practical characteristics of the existing data sources affect the local data use for injury prevention activity?

The fourth substudy. The aim of the fourth substudy is to explore the national health and safety recommendations with a potential impact on enhancing injury surveillance and monitoring for local injury prevention. The research questions are:

1. What are the Finnish health and safety policy recommendations on injury surveillance since 1986?
2. What opportunities are there to enhance injury surveillance and monitoring data for local level injury prevention activity in the recommendations?

6 Materials and methods

6.1 General structure of the study

The general structure, goals, design, and methods of the empirical study is presented in Figure 2. The study is explorative and interpretative and uses both data and methodology triangulation. The study seeks evidence that has practical significance for identifying opportunities and barriers to injury prevention activity at local level (Nutbeam 2000).

Since injury monitoring at the local level is an almost unstudied topic in Finland an exploratory approach was chosen. The topic is explored using four different, but interrelated approaches. In the first substudy local practitioners' viewpoints on injury information and on conducting injury monitoring and surveillance activities for local injury prevention are explored. In the second substudy an initiative to enhance the information base for prevention by developing injury registration in EDs is studied. In the third approach existing national information systems, containing information on accidents and injuries, are investigated. The fourth approach explores national recommendations on injury surveillance.

The first approach is a bottom-up approach that assumes that local practitioners are important, not only as the recipients and users of data and information in order to conduct the injury prevention activities, but also as information sources to those working higher up in the organisations at the local and national levels. The second approach, on the other hand, examines the processes of change in one key data provider organisation at the local level by investigating the initiation and implementation process of injury registration in two EDs. The third and fourth approaches are both top-down approaches, which assume that organisations at the national level are important and the strategies, traditions, work practices and choices made at the national level, in national organisations, affect the availability and usability of data and information for local level health and safety promotion practices.

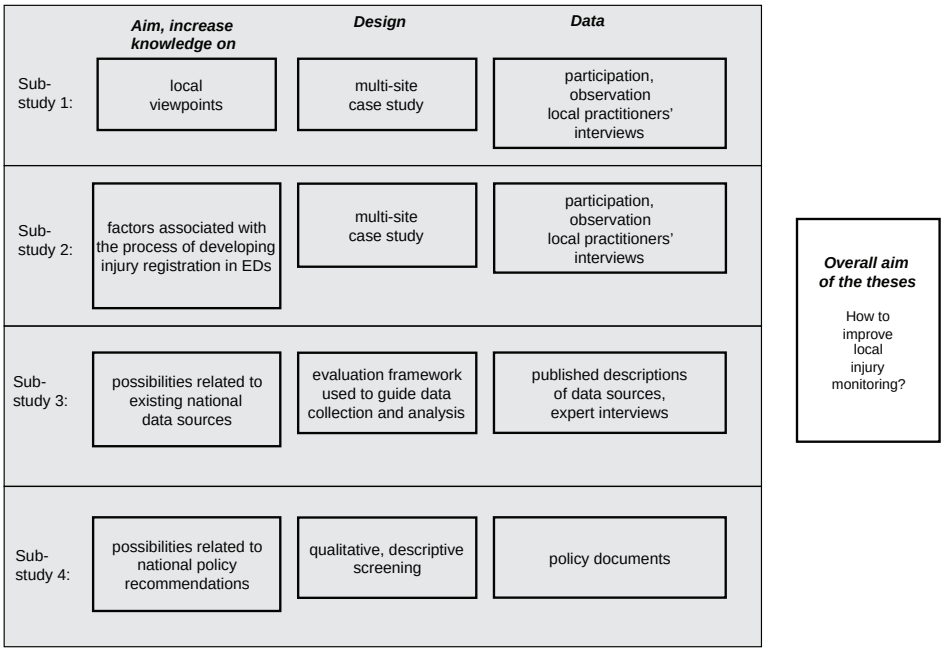

Figure 2: General structure of the study

6.2 Settings

6.2.1 The Finnish context

Finland is a Northern European country with population of 5.3 million in 2008. The proportion of population aged 65 years or older is 16.7%. Only 2.7% of the population is foreign citizens permanently living in Finland. At the end of 2008, over 50% of the Finnish population had attained post-comprehensive level educational qualifications and over 67% lived in an urban environment. (OSF 2009b.) Municipalities are ruled by self-government, and politicians for local government are elected in general elections. Local authorities are responsible for organising and shaping the health and welfare system in their particular municipality or city council, according to local conditions. The municipalities are responsible for implementing a wide range of welfare services from health care to care of the elderly and disabled.

The care of injury patients in Finland takes place almost totally in public EDs and hospitals in both primary health care and specialised medical care. Injury patients with insurance coverage may use the private sector services. Majority of occupational health care is also provided by private provider organisations. Finland has five university hospitals that treat the most severe injury patients. The public pri-

mary health care and specialised medical systems, even though administratively separate entities, do collaborate in offering emergency care at the regional and community levels. It is not uncommon that they even share the same facilities. The ED within the primary health care may be open during the weekdays and evenings only. During the weekends and nights all injury patients are treated by EDs within specialised medical health care. The structure of the Finnish health care system has consequences for comprehensive injury surveillance: data from both primary and specialised health care are required.

Systematic and coordinated work in occupational and traffic safety and in suicide prevention has existed for several decades. Today there is an increasing political commitment to enhance activities to reduce injuries at home and during leisure time and in intimate partner and domestic violence. Recommendations to foster and support development in these areas are included in several national policy initiatives, i.e. The Internal Security Programme (Ministry of Interior 2004; 2008), the National programme to reduce health inequalities (Ministry of Social Affairs and Health 2008b), the National alcohol programme (Ministry of Social Affairs and Health 2004), as well as in health promotion, violence and injury prevention policy documents (Ministry of Social Affairs and Health 2001; 2003a; 2008c).

6.2.2 Organisations

Hatch and colleagues (2006, 39) argue that when studying organisations it is important to define their level – this organisation is a subsystem to something and has subsystems of its own that could be studied as organisations in their own right. In this study the setting for injury monitoring is a municipality, hence the definition of the level of organisation is not easy. The level of organisation is defined in a most precise way in the second substudy where the EDs are the organisations studied. In the first substudy, where the local actors' viewpoints are investigated, the organisations and the positions of employees in the organisations vary. Thus the level of organisation as well as the outer and inner contexts (Pettigrew 1995) vary. Some work in health care, some in municipal administration, and others in the police and rescue services or other organisations contributing to injury prevention in the municipality. Each employee and organisation has their own context. In the third substudy the organisations studied are national statistical, expert and research organisations. The persons interviewed work in senior expert positions in several organizations at the national level. The target organisations and municipalities were not selected at random.

Municipalities. The focus group interview material for the first substudy comes from six municipalities (Hyvinkää, Kouvola, Kurikka, Oripää, Pori, Tornio) and from one region (Äänesseutu) where three municipalities conduct injury prevention in collaboration. The region is treated as a municipality. In all of the selected municipalities either one person or a couple of persons have a coordinating role for the

injury prevention activity, and an inter-organisational action, planning or coordinating team exists. The status of these teams or working groups varies. In some municipalities the local government has approved the organisational structures where as in other cases a more informal form of collaboration exists. The municipalities are located in different parts of Finland and vary according to their size, demographic features and typical sources of livelihood. The northernmost municipality is located in the Province of Lapland, the number of inhabitants in the smallest municipality is below 2 000 and in the largest over 75 000.

Outpatient clinics. The organisations in the second substudy are two EDs. They are unscheduled care settings; walk-in centres that also provide out of hours service. One of the EDs operates in a primary health care setting and the other one in a regional hospital that provides specialised medical care. The cases selected are important for three reasons. Firstly, the two EDs are early adopters of detailed injury registration. They represent the first time that a comprehensive injury monitoring system for local injury prevention was pursued in Finland. Secondly, the two selected settings, EDs within primary health care and specialised medical care hospitals, are both major service providers for injury patients, and, thirdly, the organisational settings (primary and specialised care) differ from each other in various ways. The population base was over 80 000 inhabitants for both clinics at the time of the study (Nurmi-Lüthje et al. 2007; Nurmi-Lüthje et al. 2008).

Statistical organisations and other data providers at the national level. Two national organisations that collect injury relevant data, Statistics Finland and THL, hold the status of an official statistical organisation. Statistics Finland produces the Finnish cause of death statistics, official occupational accident statistics and official road traffic accident statistics. Statistics Finland employs more than a thousand experts in various fields. It is the only public Finnish authority specifically established for statistics. (Statistics Finland 2010.) Statistics Finland coordinates the national as well as the international statistical activities in Finland.

THL is a research and development institute under the Ministry of Social Affairs and Health and is the statutory statistical authority in the field of health and welfare statistics. In addition to registering data, THL collects injury relevant data via several surveys repeated at regular intervals. Other national organisations, such as Liikenneturva, a NGO for traffic safety in Finland, that conduct injury prevention activities also further process injury data, collect additional data and disseminate information. Furthermore, some universities collect data that could be utilised for injury monitoring. The FAII is mandated by law to collect data on occupational accidents and The Finnish Motor Insurers' Centre on traffic accidents.

6.3 Data

The research uses a variety of qualitative data: focus group and personal interviews, both printed and electronic documents, and participatory observations. The data and their use in the three different approaches are presented in Figure 3 below.

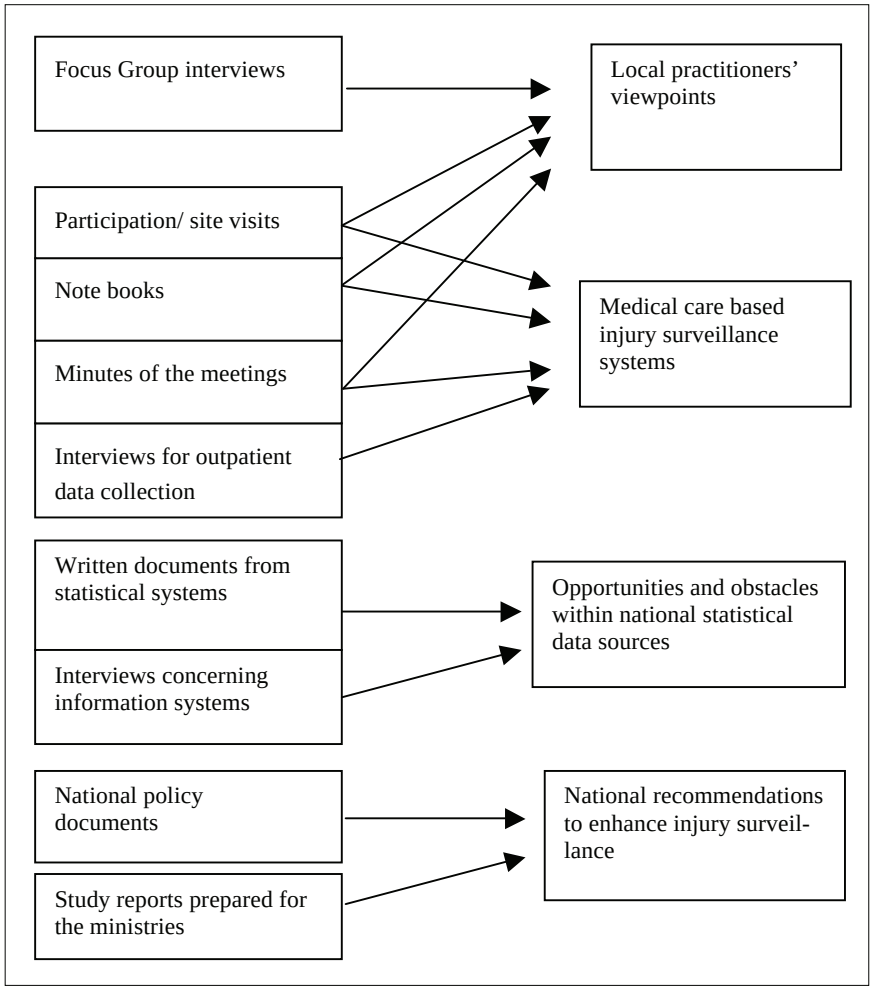

Figure 3: Data used in the four substudies

Focus group interviews

Focus group interviews formed the central data set for the first substudy. The focus group interviews were conducted in 2000 in six municipalities (Hyvinkää, Kouvola, Kurikka, Oripää, Pori, Tornio) and one region (Äänesseutu) that are members of the Finnish Safe Community network. The primary purpose of these interviews was to

find out what kind of support the local practitioners would benefit from in conducting municipality based injury prevention activities. One of the themes in the interviews was injury monitoring and data needs. The focus group interviews were planned for scientific purposes and archived accordingly.

Altogether 48 employees attended the group interviews. Those interviewed were key injury prevention practitioners, administrators and directors in local government. A variety of sectors of the injury prevention activity within the municipality and other local organisations were represented in the groups. The distribution of the interviewed people by sector was: social services (N=10), health services (N=7), technical branch (N=7), education (N=6), other municipal employees (N=10) and others (N=8). Interviewees working in social services comprised directors of social services, directors of elderly and disabled care, home help social workers and day care workers. The health services interviewees included physicians working in primary health care, public health nurses and visiting nurses within home care. The interviewees working in the technical branch included workers from maintenance, and environment including planning for bicycle lanes. The education group included teachers, head masters and librarians. Other municipal employees included municipal managers, vice municipal managers and occupational safety personnel and the class 'others' included workers from the police and rescue services and the local branches of the Finnish Red Cross.

The focus group interviews were all moderated by two injury prevention experts. The researcher responsible for this study was a moderator in all interviews and five different people acted as the second moderators. The interviews were carried out along 'a priori' planned themes. The main themes were: the organisational structures of injury prevention activities in the municipality, management of injury prevention in which injury monitoring was a sub theme, cooperation and target areas. The moderators encouraged the interviewees to talk as much to one another as to the moderators. The discussion was taped with the permission of the participants and directly after the interview the moderators wrote detailed notes of the discussion. All of the interviews were performed in the relevant municipalities in order to make it as easy as possible for the interviewees to attend the group discussions. Local contact persons arranged the time and place for the interviews, and informed the injury prevention work groups and other important stakeholders. A formal invitation letter to participate into the focus group discussion was sent to each identified stakeholder.

Interviews for outpatient data collection

The process of building up an injury data collection system for local injury prevention is the topic in the second study. Information sources comprised project participation, note books and minutes from meetings. In addition, key informant interviews were conducted. The total number of interviews was eight, out of which seven were one-to-one interviews and one a group interview with three people. In total 10 peo-

ple were interviewed, out of which three were employees in primary health care, four in specialised health care and one each from the project management, the IT-company and the municipal administration. Both physicians and nurses were among interviewed personnel.

The rational for selecting the interviewees was based on the principles of Rubin & Rubin (Rapley 2005, 17). Initially, it was important to identify knowledgeable informants and to get a range of views. The actors whose opinion was seen to be important were 1) people from the project organisation, 2) end users of the patient record system, who are people working in the out-patient clinics and using the it-system every day in patient contacts; both nurses and medical doctors, 3) people responsible for the development of patient record systems, both in companies and hospitals and 4) administrative people playing a role in decision making. The first people interviewed were: the person in the leading position of the project and head nurses in the outpatient clinics in both settings. The interviewees' opinions as to which people were important for the project development were asked for. This affected the choices for the next interviewees. It was made clear that the researcher was not only interested in those people that might have played a role in making the project successful, but also in those who have been critical about the project and could provide an opposing opinion. Moreover, practical matters such as the working shifts of the nurses affected the selection. For practical reasons the interviews were carried out during the nurses working hours. The interviews were conducted in the middle of the day when the morning and afternoon shifts changed. The interviews did not affect the work of the clinic. From the beginning a serious attempt was made to get a range of views on the topic (Rapley 2005). The first interviews were conducted in May 2007 and the last ones in April 2008. The interviews were performed in three "sets". After the first and second set the interviews were typed and preliminary analysis was conducted. Hence the initial outline and the list of questions were further developed after each set of interviews (Rapley 2005).

A formal written approval was asked from the hospital to interview the hospital staff. All of the interviews were tape recorded with the approval of the interviewees. The interviews were a mixture of conversation and interviews with open ended questions. The researcher knew some of the interviewees beforehand, having been involved in the project from the early stages; the researcher met the others for the first time in the interview situation. The shortest interviews lasted 55 minutes and the longest group interview for two hours. To aid the interviewees' memory, a diagram showing planning, initiation, data collection and other important events was presented during the interviews.

Participation/site visits

Participation in municipality based developmental programmes is one source of data. STAKES (in 2012, after a reorganisation of the national agencies STAKES has

become part of THL), the Finnish Institute of Occupational Health and Liikenneturva, the central organisation for Finnish traffic safety, began cooperation in 1998 to promote comprehensive community based injury prevention and safety promotion work in Finland. Three development programmes influenced by the previous Safe Community programmes in the other Nordic Countries were conducted. The first comprehensive municipal-based injury prevention programme was conducted between 1998–2000 (Koivukoski et al. 2002), the second one, between 2002–2004, targeted school injuries in a community setting (Lounamaa et al. 2005) and the third development programme began in 2000 (Nurmi-Lüthje et al. 2007; Nurmi-Lüthje et al. 2008). The most recent data are from 2008 and 2009, while two new regional injury prevention programmes have been in a planning stage. Already, at the initial stage in the development of injury monitoring, tools for local injury monitoring are among the targeted areas.

The development programmes have all had a national dimension and a requirement to develop injury prevention methods in the Finnish context. Each programme could be considered a demonstration program (Ekman et al. 2008). Local injury monitoring has been an important topic in each. In the first and second programmes cooperation with municipal employees and other local actors was intensive. During these programmes the researchers travelled several times a month in the region, to meetings for planning, for steering group meetings and for other meetings, as well as for seminars and other activities. The researchers were active at many levels and influenced the activities in the municipalities throughout the programmes. Thus, the researchers' position was largely that of an action researcher (Heikkinen et al. 1999, 25-62). The third programme was different. The researchers were active in the initiation phase, but as the programme began a full time project leader was hired and the role of the external researchers became less intensive. Steering group participation was the form of involvement by the researchers.

Note books

Real time data collection consist of material that is collected by observing present activities (Kerosuo et al. 2006). This kind of data could be called observational material, participant observation or own documentation. The information is stored in note books. The books consists of notes the researcher has written while attending meetings and seminars. The notebooks include notes on what has been discussed and what decisions have been made. Kerosuo and colleagues (2006) use the term 'brief ethnographic visit' for short-term field visits during which, for example, problems posed by on-ongoing projects can be negotiated. In addition to notes from "official" meetings, information on several work meetings related to projects was stored. All of the notebooks have been archived in chronological order. A total of 12 note books were used for this research. They cover the time period from 1995 until 2010.

From the beginning of the developmental programmes, the aim was to evaluate them. Therefore diaries were kept. However, the decision that the note books would be used for a scientific study was made later. Thus the notes in these books were not as detailed and structured as they would have been if they were intended for scientific use. Nonetheless they form a valuable information source when used together with other data sources. They provide information about who has attended meetings, what has been said and by whom and the researcher's personal impressions of the meetings, such as "Mr. X didn't seem to be too interested". The chain of meetings that has taken place during the programme period is documented within these notebooks.

Minutes of the meetings

The minutes of the meetings collected include those from planning meetings at the initiation phase of the programmes, local steering group meetings and for the first (1998 – 2000) and second (2002 – 2004) community based programmes also minutes from the local action/co-ordination group and project meetings. The local steering groups meet usually a couple of times each year. The intensity of the action group and project group meetings was greater. In the active programme phases the researchers visited the municipality several times a month. The minutes are stored in electronic data files.

Documents from statistical systems

In the third substudy only information systems that collect injury data for national organisations are included. Since the author has worked previously in an organisation responsible for national health care and social welfare statistics, some of the written documents were in the researcher's archives. Also an internet search using Google was conducted to find appropriate documents. Google is especially appropriate to find grey literature. Experts in the field were contacted and snowball techniques were used to identify additional documents.

In addition to national data sources and information systems, local information systems do exist in various organisations for occupational accidents and injuries, in elderly care, schools or day cares. Furthermore, some emergency departments in highly specialised hospitals collect data that exceeds in content and detail the national data requirements. This kind of clinical data is valuable for prevention also at a local level (Schaechter et al. 2007). A separate study is required to examine the data sources, but due to the magnitude of such data collections such an examination is beyond the scope of this thesis.

Interviews regarding statistical systems

The information from written data sources was complemented by questions submitted to experts by email or by contacting them by telephone. In addition, personal interviews complemented the written material. Those interviewed were experts on particular information systems: people in charge, who have been involved with and closely linked to dissemination. The rational of selecting interviewees was based on the limited information available otherwise. The main purpose of the interviews was to obtain detailed information on particular statistical information systems. A total of 10 people were interviewed: one of the interviews was a group interview and the rest were personal interviews. In the group interview four people from the Finnish Motor Insures' Centre were interviewed. Personal interviews were conducted with one individual from each of the following organisations: the Social Insurance Institution, the National Police Board, the Emergency Services College, the Ministry of Transport and Communications, the Federation of Accident Insurance Institutions and THL. The interviews were conducted in winter and spring 2009. During the process of data analysis those interviewed were recontacted.

Policy documents and study reports for injury surveillance enhancement

The fourth substudy was based on two types of data: national policy documents and study reports. Policy documents included national strategies, targets and developmental programmes. The inclusion criteria for policy documents were that they included recommendations for specific injury types or overall injury surveillance recommendations. The inclusion criteria for discussion papers were that they included recommendations and proposals to enhance injury surveillance and that they were prepared by experts for ministries. A total of 22 documents (Appendix 2) with recommendations were identified.

6.4 Data analysis

The four substudies, although independent studies, had similarities in the data analysis. The goal of the analysis was to extend the understanding of opportunities and obstacles in enhancing injury monitoring for local level activity. In the analyses the oral and textual data is used as factual statements and treated accordingly. The place for the interpretation of the data is in the discussion of the findings. Study questions, a predefined framework, concepts and their relationships with each other guided the analysis of textual data (Eskola et al. 2000, 197; Hsieh et al. 2005; Ulin et al. 2005, 141).

The first substudy

For the first study approach the process of data analysis began with reading the texts and notes. Since analysis of the focus group interviews, note books, minutes of the meetings and person-to-person interviews was not only limited to monitoring related text, all relevant observations related to injury surveillance and monitoring were selected and copied into one Word document at the beginning stage (Eskola et al. 2000, 174; Ulin et al. 2005, 147). Thus the core document for further analysis was composed of selected texts from various documents.

Content analysis was used to analyse the textual data (Hsieh et al. 2005). Labelling and using words to flag ideas was begun already when reading through the transcripts and reviewing the research material (Ulin et al. 2005, 147). Labeling and flagging continued whilst reading the constructed document. After reading and re-reading the original texts and listening to the original interview tapes, the text in the document constructed from the original text pieces was reorganised using the study questions and categories that had emerged during the review process. This step is called preliminary analysis (Ulin et al. 2005, 139).

The preliminary analysis was followed by a reduction process. The reduction process began once all of the data were compiled in one document and the researcher was familiar with their content. (Ulin et al. 2005, 160.) Matrices and diagrams were used as visual devices to get an overall sense of the data, to distinguish central themes and relationships between the data and the core concepts of the study: organisational change, systems and contexts. The goal of the reduction process is to make visible the most essential concepts and relationships (Ulin et al. 2005, 161).

The second substudy

The goal of the second substudy was to study a process of building up an injury registration system in two EDs. This process was just one part, a subproject, of a wider injury prevention and safety promotion initiative, and was the first step to advance injury prevention activities in this region. The second substudy used multiple qualitative data and theory guided content analyses. Hsieh (2005) refers to theory guided content analyses as direct content analyses. The goal is to validate or extend conceptually a theoretical framework. In direct content analyses existing theory and frameworks are used to provide guidance and help to determine coding. (Hsieh et al. 2005.) The theoretical background is based on an analytical framework for diffusion innovation theory in service organisations presented by Greenhalgh and colleagues (2004; 2008). The framework is presented in the chapter 3.7.

The analysis of the interview data was already begun during the data collection phase as the interviews already conducted interviews were to affect the coming ones (Ulin et al. 2005, 139; Øvertveit 1998, 225). When all of the data were collected the first step in data analyses was to form a process description. These write-ups were

simply pure descriptions, but they were central in generation of insight and they helped to cope with the large volume of data. The overall idea was to get familiar with both cases as a stand-alone entity. (Eisenhardt 1995). The aim was to form a picture of the course of events and to identify the main events affecting the process. The key events and the social constructions of these events in their contexts are important (Pettigrew 1995). To understand the underlying logics in the process of change requires interpretations of the events which then helps in understanding how and why changes occur in chronological sequences (Pettigrew 1995). Next, in order to identify obstacles, barriers and factors which support or pose obstacles in injury registration the data is analysed using the conceptual framework presented by Greenhalg and colleagues (2004; 2008).

The third substudy

Instead of reviewing data sources one by one, they were analysed in groups of data sources. The identified data sources were grouped into five groups before analysing them in detail. The five data categories are: (1) nationwide administrative registers, (2) emerging information systems, (3) accident investigation databases, (4) data sources on monitoring safety promotion practices, and (5) population surveys. The grouping was performed for practical reasons and the principle underlying the grouping was to get similar data collections in each group. After the grouping was completed, it was easier to compare the characteristics of each particular data source with other similar data collection systems.

The evaluation framework for injury surveillance systems (EFISS) was used as a conceptual framework for analyses. The EFISS is presented on chapter 3.7, and in detail by Mitchell and colleagues (2008; 2009). The evaluation framework provides an outline to assess data quality and operational and practical characteristics. Of the 17 items in the original framework, four were excluded from this study: positive predictive value, confidentiality and privacy, system security and quality control measures. Since no empirical data was collected for this study, it was not possible to assess the positive predictive value. Access to individual level data is strictly regulated and in most cases original data cannot be accessed outside the relevant organisation, thus the two operational characteristics, ‘confidentiality and privacy’ and ‘system security’, were excluded. The operational characteristic item ‘quality control measures’ was also excluded. For the purposes of this study the final quality of the data was considered to be important instead of the means of gaining it.

Since most of the data used for this substudy was classified as grey literature data or was received by interviewing and contacting experts, the analytical description for each data source was sent to the responsible organisation for comments. This was considered necessary, since information related to each data collection system was based on a variety of data.

The fourth substudy

The fourth substudy comprised a document analysis of recommendations and proposals to enhance injury surveillance. Content analysis was conducted to explore the national pursuit of improving local injury monitoring. In order to make an inventory of recommendations a descriptive screening of national policies and study reports was conducted. All recommendations related to injury surveillance were selected for further analysis. In total, 106 recommendations were subsequently analysed with regard to their potential impact on local injury surveillance or monitoring enhancement: (1) recommendations clearly directed to enhance local injury surveillance and monitoring, (2) recommendations that were not targeted to enhance local injury monitoring but that had potential to improve monitoring in the future and (3) recommendations with no immediate concern for local monitoring. An example of each recommendation category is shown in the Table 3.

Table 3: Recommendation classification with an example

Potential impact on local injury surveillance or monitoring enhancement	**Recommendation**
Recommendation directed to enhance local injury surveillance and monitoring	At the local level - in day care, at schools and in educational institutions – information systems to monitor injuries and acts of violence will be developed.
Recommendation with potential to improve local injury surveillance and monitoring in the long run, but not directly targeting local monitoring enhancement	Data collection from ambulatory care will be developed.
Recommendation with no immediate concern for local monitoring	Information systems and data fields within them as well as data transfer protocols need to be developed.

The recommendations are considered as representations of what the problem is presented to be by national stake holders and experts (Coveney 2010). The conceptual framework used for the analysis is the EFISS that defines data quality, operational and practical characteristics as important injury surveillance system components (Mitchell 2008; Mitchell et al. 2009).

7 Local viewpoints

In this chapter the study results of local viewpoints on data collection, injury information, surveillance and monitoring are presented. Focus group interviews in municipalities are the main data source, thus results represent the viewpoints of local practitioners who have participated in multi-sectorial local community-based injury prevention activity. The main themes explored are information needs, justifications for data collection and information requests, barriers to collection, access to and work with injury data, and explanations given for local data collection as well as the perception of injury registration in health care.

The qualitative content analysis used in this study is conventional content analysis (Hsieh et al. 2005) in which the categories are not predefined according to existing theory. Instead the categories are data-based and formed during the data analyses. The categories are thus based on the researcher's interpretation of the data. According to Hsieh and colleagues (2005) the advantage of the conventional approach of content analysis is "gaining direct information from study participants without imposing preconceived categories or theoretical perspectives". The subsections are organised based on the study themes and categories that emerged during the data analysis.

7.1 Information needs

In this subchapter the what -question is asked and the main theme explored is the topics that local employees would like to have information about.

The need for general epidemiological information is raised both by municipal managers and by "grass root" injury prevention practitioners. The most commonly mentioned information request, as could be expected, is to gather information on the overall injury situation in the area. Secondly local employees request trend information. These two information requests seem to be the most common and are sustained even when actual injury prevention work proceeds.

> *We should have statistics. We should know if there have been injuries in the municipality (Director of elderly care, 2000).*

Even though the central data requests endure, empirical data suggests that information requests are not a static phenomenon, instead information requests change. Information requests change according to the profession and employee, the region and time and also as experience in the injury prevention work is gained. The period during which the active members in the municipality's injury prevention group alter the way they perceive the injury problem is short. In the early planning stages of a

new injury prevention programme discussion covers traffic accidents, work accidents and maybe elderly falls. Such topics as intoxication or drowning are rarely mentioned. More specific information requests are presented by local employees and they also start to identify information gaps quite quickly as they gain experience in the field. These findings are based on two types of observations. Firstly, statements recorded in group interviews suggest that those who came from municipalities where a community-based programme had been operating for several years presented more specific data requests than practitioners who were working in municipalities that had only recently started their comprehensive, community based activity. Secondly, note book annotations and field visits suggest that more specific information requests are raised surprisingly soon after the initiation of a new programme.

Examples are a public health nurse who had been a key person for several years in a community-based injury prevention programme highlighted information gaps related to home injuries:

> *…we totally lack information of what happens at homes, especially to elderly people (Public health nurse, 2000)*

and a city engineer related to pedestrian and cyclist injuries:

> *…there is no information of the slips, trips and falls of pedestrians and cyclists. (City engineer, 2001).*

Information requests are not restricted to injury incidence statistics. Local employees also have several other information requirements. They wish to obtain quite detailed information on specific injury themes. They pose questions regarding citizens' knowledge of safety and safety-related behaviour.

> *it would be important to have a better understanding of the students' safety knowledge at vocational schools - what they know of injury risk factors and safe behaviour (Teacher, 2000).*

In one such case, a public health nurse wanted to have

> *better and more accurate safety behaviour statistics (Nurse, 2000).*

As an example, she wanted accurate follow-up data collection on helmet use.

Information on the short and long-term costs and overall consequences of injuries are frequently asked for. Information on close to an injury situation are mentioned as an important item to be monitored systematically in schools, elderly care and children's day care centres. However, the data do not show information requests

on work practices for safety improvement, such as how many schools in the municipality conduct regularly risk assessments, or on the amount of activities conducted for safety promotion.

7.2 Justifications for information needs

Local practitioners are well disposed towards data and information from surveillance and monitoring systems. They frequently mention several uses for such information and how injury prevention work would benefit from it. Information needs are justified primarily, and most often, by information needs for injury prevention management, planning and evaluation activity. Secondly, information needs are justified by arguments associated with persuasion. Thirdly, data is needed to improve the quality of services. Fourthly, individual employees often have a desire to get feedback on their work. Information needs are also justified by legal obligations. The sixth identified justification for data and information is to fulfill Safe Community recommendations.

1. Management, planning and evaluation. The most frequently mentioned justification is, as could be expected, to have information for managerial purposes. Information is often requested for planning, developing and evaluating injury prevention activities in a municipality. A commonly mentioned reason for the need for injury information is "*to know what to do*", to identify problem areas and define injury prevention targets. Both municipal directors and more widely all members in such injury prevention work groups, from various local organisations and positions, highlight the value of information for planning and evaluation.

> *If we only had a monitoring system it would then be easy to process it further. We would know what we should do. (Rescue service employee, 2000)*

Town managers and others in a municipality's lead position, as well as the injury prevention work groups' members, emphasise evaluation functions of the information, to see if any changes have occurred in the injury situation.

> *So we could compare and estimate whether we have accomplished something and generated any results. …So we could then estimate whether we have done unnecessary work, or if should the work be changed in some way. So we know what we should focus on instead. (Rescue service employee, 2000)*

Once local practitioners have had access to detailed local accident or injury information in order to guide preventive and promotive actions they are prone to request for

more. Well presented local information seems to support the desire to even extend data collection. Employees in local settings value detailed, local accident and injury data. They appreciate local information that is able to show the extent of the problem in an area and that can pinpoint target areas for injury prevention work. One such academic study, in one region, acted as a facilitator to initiate structured and goal oriented injury prevention in that particular region. Falls, self-inflicted injuries and alcohol related injuries were clearly pointed out as problem areas.

> *At the same time, this sub-regional health study, made by a researcher, about the health status of the population of the subregion was completed and the report on these numbers … was presented … to the municipal decision-makers and the personnel of the health centre. (Public Health Nurse, 2000)… Thus, indeed, the basic premise was concern about the safety of the population of the region. (Rescue service authority, 2000) … so, in the beginning, in this health study, falls are common in this population and, in particular, that was chosen to be such a focus. (Public health nurse, 2000)*

During the group interview the people from this particular region brought up the need to get a range of information to support planning activities in the future as well.

In another municipality, improvements in the level of detail in traffic accident data collection was mentioned as a major reason for the success in decreasing the number of traffic accidents. The traffic accident data collection had been strongly supported by the municipality's management team. As the scope of injury prevention in this particular municipality extended from traffic accidents to other kinds of accidents and injuries, the first action, recommended by the municipality's management team, was to develop a comprehensive injury surveillance system. A project to develop injury surveillance for local use was strongly proposed by the municipality's management team and actually named as a prerequisite for future injury prevention activity.

2. Persuasion. Local practitioners justify local data needs by arguing that such data is needed as a means of persuasion, to convince others, especially decision makers. They want to demonstrate that it is worth investing into injury prevention and safety promotion and that resources are needed for such work.

> *… to show that injuries are a problem, to show that injuries are expensive (a teacher, 2000).*

> *One must be capable of justifying for the municipal administration, why injuries must be prevented. (Manager, 2005)*

Since such data is needed to convince the decision makers, it is important to use data and language that the decision makers understand.

> *We need the cost information. It is important to show these figures to municipal leaders. They are interested in expenses and the financial figures arouse the municipal leaders' attention. (Employee of rescue services, 2009)*

Furthermore, local practitioners often discuss persuasion targeted at the general population. Information is needed in activities targeting attitudinal and behavioural changes.

> *But my main concern was the attitude, it should really be shaped. And that is hard. This means that there should be a model, factual knowledge should be produced, even these numbers should be shown. For instance, at a recent exhibition, a quiz was arranged, where these daily injury numbers were asked and how many people have died in fires during this first quarter. These figures REALLY awaken people. (Occupational safety authority, 2000)*

3. Improving the quality of services. Middle level managers say that surveillance could be used as a tool to increase employees' capacity to recognise injury hazards and to take responsibility for the customers' safety. The quality of services viewpoint was brought up by people working in health care, social welfare, schools and elderly home care. One notion made was that data ought to be collected, not only to identify injury hazards and to remove risk factors, but also to show customers and their relatives that safety measures are taken seriously, that elderly care, schools and day care facilities are safe and that they actively aim to improve safety.

> *Training of the home help service personnel to recognise fundamental questions is important. (Public health nurse, 2000)*

> *I think that preventive measures for accidents imply that we start with activities at the grassroots level. In other words, regardless of the occupation or assignment a person works in she must, in her work, sort of take into account matters that affect for instance the risk of injuries. In other words she must observe and learn how to observe her environment. With regard to senior citizens, we have started with this theme … such a survey of the security in the homes of the elderly … that she (the employee paying a home visit) understands that it is she who has the key influence on this matter.*

> *… we are going to carry out security surveys in the homes of the elderly … In this way, we are trying to train the employee. (Manager in social services, 2000)*

4. To get feedback on ones work. The fourth identified justification for information is the interest in feedback that employees have. They wish to have feedback information on their own work. This justification for information is related to evaluation, but rather than being evaluation for management purposes, this information need is justified by the desire to get feedback on the success of ones own work. In this respect the information need is personal or communal instead of managerial.

> *…to show that our work has had an impact, that we have done right things (a teacher, 2000).*

5. Information to conduct statutory work tasks. The fifth justification for injury information was given by rescue service authorities. They commonly say that injury prevention is part of their statutory work. To conduct the obligatory tasks to prevent accidents and injuries as defined in legislation, they need information. Rescue service authorities were the only group that brought up the legislative justification.

> *In the rescue act, injury prevention is mentioned there, but it is difficult to get an accurate and comprehensive picture of injuries in the region (Employee of rescue services, 2000)*

Since 2008 regional injury reports have been available for rescue service authorities.

> *We have had an obligation to conduct comprehensive injury prevention work. Until now we have been unaware of the injury situation. Now the injury problem field begins to have some form. (Employee of rescue services, 2009)*

6. Safe Community requirements. Some municipalities expressed specific needs for surveillance data. The justification for a surveillance system is to have an on-going injury monitoring system to fulfill one of the prerequisites when initially applying for membership of the International Safe Community network and later in order to stay in the network. Local practitioners are genuinely willing to show that injury prevention work is conducted in a professional manner and they are dissatisfied with the nonexistence of local information.

7.3 Data that are used

Information available for safety promotion and injury prevention in the local working groups is not comprehensive. On the contrary, it seems to be substantially dependent on who belongs to the injury prevention working groups. The police, the environment, and the city offices for maintenance and environmental planning are usually represented in injury prevention working groups. Thus data on motor vehicle crashes are often available and known.

People other than occupational safety workers, for example financial managers who prepare the municipality's insurance contracts, sometimes know of and mention data on occupational accidents involving municipal employees'. However, data on work accidents occurring in agriculture, industry or other organisations located in the municipality are not commonly in use by those who participate in comprehensive multi-sectoral community based injury prevention programmes.

Rescue authorities are usually well represented in the local injury prevention working groups. Consequently information regarding the magnitude of fire accidents and rescue operations conducted by the rescue service authorities is generally available for injury prevention activities.

7.4 Barriers for data use

Identified barriers to access to data and statistical information are limited knowledge of data sources, the fragmentation of data and information into numerous data sources, and lack of resources for information seeking work. The identified barriers have a significant effect on utilisation of existing data for prevention.

1. Limited knowledge of data sources. A haphazard discourse and questioning of information providers and data sources in the very initial planning phase of the comprehensive community based injury prevention programme can be commonly noticed. Based on note book annotations and further supported by the focus group interview data, it is evident that local practitioners often have limited knowledge on existing data sources. Furthermore, lack of contacts and partnership between the local parties who collect data and use the data has been observed during short field visits. Similarly a gap between national data providers and local injury prevention practitioners exists. Local employees are not familiar with injury information available in local organisations or in national information systems or statistical databases. Databases such as SOTKA, SatFinn or Hilmo cubic are hardly mentioned in meetings at a local level.

Injury prevention practitioners typically assume that injury information can be received from hospitals, other health care organisations, the rescue authorities or from Kela – The Social Insurance Institution of Finland. It is frequently anticipated that Kela will have data on injuries since they compensate for salary losses. Fur-

thermore, it is often expected that insurance companies will be able to provide injury information.

> *… we fill up all these forms for insurance companies. We should be able to get information from them. (Physician, 2009)*

Compensation claims sent to insurance companies from schools regarding school injuries are a common example of local information not in use for prevention. Even though the insurance claims are based on the municipality's own contracts with the insurance companies, it is not common knowledge among injury prevention practitioners where the filled forms are stored or for how long a time period these forms are kept in archives. It is not commonly known whether or not the forms are in paper format only or in electronic archives as well and if it is at all possible to utilise such data for local injury prevention activities. Similarly, data collected in EDs in the region is not in use for safety promotion and injury prevention. The potential of data stored in electronic patient records is not realised by local practitioners. Also insurance forms filled in the health care sector do not feature in local injury prevention. Neither local organisations nor insurance companies have taken advantage of the potential of these data for local safety promotion and allocated resources to develop data sharing practices and dissemination formats.

> *Injuries which are treated in hospitals are carefully reported, for instance in the hospital, the hip fracture reports are detailed, how many they are … Certainly, the follow-up data is mainly kept internally (in the hospital). (Physician, 2000)*

2. Fragmentation of data and information sources. The fragmentation of injury data into various data sources, in several organisations, both at national and local level, complicates the use of information and is an identified barrier to access data. One public health nurse said the following regarding a preparation process to form a local injury situation report:

> *… I rang around and tried to get a better picture of the number of injuries. I got access to the 50 most common reasons for visits in the statistics of the emergency department, many of which reasons referred to injuries. The material from the maternity clinic was ready for use. The material was the assembling of a puzzle. (Public health nurse, 2000).*

3. Lack of resources for information seeking work. In general it seems to be problematic to find the resources, an organisation or someone to take responsibility for information seeking. Often no one has been assigned with the task of injury monitor-

ing for prevention in a municipality. The research data suggest that injury monitoring tasks are difficult to initiate. Furthermore, the readiness for organisational change and the work environment in organisations participating in injury prevention at local level is not supporting and does not encourage individual workers to embark upon new injury monitoring tasks. A frequent question regarding monitoring is: whose job is it to find the data and information and to prepare the statistics and write injury reports?

> *Sometimes I feel like that at least a part-time employee would be needed in the injury prevention project. This person would coordinate the activities, maintain the material store, build up the data bank, carry out opinion inquiries, map new links of who would participate. And survey who would need safety education, training, etc. (Teacher, 2000)*

7.5 Lack of models

Since there is no easy way to initiate injury monitoring activities, the information base for injury prevention remains moderate. Limited resources and surveillance capacity together with non existing knowledge of appropriate models for monitoring injuries at local level seems to endure.

> *… we should get a surveillance system, I don't know how we could generate it … I can't tell in which way we could get it, but some kind of a monitoring and a comparability should be generated. (Rescue service employee, 2000)*

Readiness to start injury monitoring is often expressed, but there are no models easily available that could be used as a starting point. Local actors suggest alliances with national actors and seek evidence of good solutions for injury monitoring.

> *Is it possible in this country to find such a municipality which would start to develop this kind of a model. … It is difficult to say, how it should be carried out, but that we have wise administrations, which then would produce the result, … or the ways in which it is done. … so, would it be possible to produce such a surveillance system in cooperation between some municipality and for instance STAKES. … Because, in fact, there we ran out of resources and know-how, too. And a kind of nationwide view should be generated for that matter. … I thought that one municipality is not capable of creating it (the surveillance system). (Town manager 2000)*

> *But naturally it would be nice to hear, what you have there at "the headquarters", what kind of a surveillance model are you considering, and in the different municipalities, how do you think it would be good to follow up those who haven't been in hospital. Surely, it should be considered more widely, … because this certainly is an extensive work. (Physician, 2000)*

In addition, physicians ask for evidence of new practices.

> *What kind of models there are? What kind of experiences there are that have been successful. This would be important to know (Physician, 2000).*

7.6 Reasons to collect data

In chapter 7.2 justifications for information needs were presented. In this chapter local explanations for collecting data are presented. The three main categories are: national regulations, local information needs and research. The research material used for this study suggests that data collection at a local level is strongly externally determined. Binding regulations from the national level are the strongest reason to collect data. Continuous data collection is almost totally regulated by national authorities. Local modifications to mandatory injury related continuous data collection are limited to experimental or research projects receiving external financing.

1. National regulations. Most injury related data collection at a local level is statutory work. Legislation, national statistical guidelines and regulations define the data collection. Collecting data on occupational accidents, traffic accidents and hospital discharges are all statutory statistical work tasks. Defined variables, classifications and structures to collect and transfer data into national databases exist. Thus national decisions that are external to local organisations define local data collection.

> *All occupational injuries that need to be treated by health care personnel are registered and stored into records. A case investigation (tapausselvitys) has to be done of each accident and the investigation results ought to be reported to an insurance company. (Occupational safety inspector 2001)*

One experienced public health nurse in the injury prevention field identified shortages in the current injury surveillance. She also noted that national resources for support and national level capacities are important for surveillance.

> *Therefore, let's say that when it is a traffic injury or an injury at work, these are always straightened out right here while working. Indeed, they are straightened out very carefully and the issues are reviewed in employee committees and others. But then, if we think of the domestic injuries, how they occurred or occur, this certainly is an issue which we actually can do very much about in the future. … so, the injuries at work and the traffic injuries have their own background influentials and actors, but for the domestic accidents, there is no support network. (Public health nurse 2000)*

2. Locally defined purposes. The second identified motivation for collecting data stems from local needs. Two different kinds of data collection cases emerged in the study material. In the first one, a decision to start continuous accident surveillance on a specific topic was made. In the second one, data collection was conducted for a defined time period on a certain topic. The motivation for data collection in both cases was to collect data for locally defined purposes.

The threshold to starting continuous data collection is high. Efforts to initiate data collection seem to be rare even though information needs are frequently presented. Alcometer readings are mentioned on several occasions as one such important piece of information that should be measured for all injury patients. The software used in information systems poses a barrier on locally defined data collection and do not offer the flexibility needed. Indeed IT system modifications for injury surveillance were not in use in any health care organisations when the research data were collected. But it was known that in some primary health care clinics outside the study regions such modifications for other purposes exist.

> *But, but, these smart health care organisations that I remember when I had … been part of these development things of the outpatients statistics … From that, they have just elaborated this, kind of, smarter version. Like developed by themselves from it. And from there they get out anything, you name it. And surveillance, they really survey. (Local practitioner, 2007)*

Short-term locally defined injury data collection is quite common, however. Most of the municipalities from which data for this study were collected have conducted data collection for short periods. These short-term data collections were reported to be quite easy to organise and conduct.

> *A short-term follow-up of all injuries treated in primary health care could be done. In one project data were collected on hospital treated injuries of people over 65 years for 6 months. (Head physician, 2001)*

3. Research. The third motivation for data collection is research. Workers in several municipalities mention short-term injury data collections on a specific topic like hip fractures, school injuries or accidents in nursing care facilities. These data are collected for local, multi-site national or international studies and research projects. They are frequently ad hoc data collections.

7.7 Expectations towards health care

Possibilities within the health care sector to provide information for injury prevention has been a topic of discussion in several local meetings and it has been hoped already for many years that the development of information technology, medical information systems and electronic patient records could at least partially solve some of the injury surveillance and monitoring problems experienced in municipalities. In 2000, when the focus group interviews were conducted, the possibilities to improve injury statistics were brought up in the context of medical information technology improvements. In 2000 it was expected that it would be possible to collect injury data in emergency departments in primary health care in the near future. However such development has been slow. Nonetheless, public health nurses and other injury prevention work group members have expectations towards health care as the main data provider.

Limitations related to current data collection in health care are identified by local health care workers. The first such limitation is the *reason for care* -classification in primary health care emergency departments. The classification is not specific enough. It only allows classification of the reason for care as an injury without any other details. The second identified limitation is that the IT systems may not allow multiple coding, such as alcohol and injury together, as the reason for care. The third identified limitation is the scarce amount of information on accident circumstances and injury causation entered into the information systems: i.e. data on where, when and in what circumstances the accident occurred.

> *When a person comes into emergency department to be treated, we of course ask what happened. But we don't ask in a way that we ought to for prevention. Matters associated with the injury occurrence are not asked. The drunkenness would most likely be marked up but for example what kind of shoes she had, we do not ask. (Public health nurse, 2000)*

Concerns related to injury registration in health care are also expressed. Increased workload is one concern and data security issues another. Both physicians and public health nurses brought up to the increased workload in 2000.

> *It is possible to carry out a short-term follow-up (sample). Continuous data collection means increased work for the doctors. (Physician in primary health care, 2000)*

Some more recent comments may indicate changes among physicians even in primary health care.

> *Surveillance is our basic mission. (Physician in primary health care, 2009)*

Privacy and data confidentiality issues were also highlighted and discussed in school safety project meetings. Public health nurses working in schools are health sector employees, whereas teaching staff are education department employees. Teachers and other staff at school generally have data on accident circumstances, whereas the public health personnel have data on the consequences. Both types of data are needed for proper injury surveillance. When organisational borders meet, for example in a school setting, and injury registration utilises personal identification numbers, there are challenges posed regarding data confidentiality. Access to health data is highly regulated.

> *If personal identification numbers will be used in injury registration, the data confidentiality issues must be taken seriously: Who is allowed to handle the information? Who has the right to have access to data concerning individual students, for how long and where is the material stored? (Public health nurse, 2003)*

7.8 Summary of results

Local injury prevention practitioners have multitudinous data needs for injury prevention and the identified information needs are associated with the stakeholder. Managers in a municipality need to know the injury burden of the population in that municipality and how the injury situation is developing. Detailed information on injuries, their causes and outcomes as well as on wide range of factors associated with injury occurrences is equally important for middle managers, directors and care givers in elderly care environments, or teachers at schools to improve safety. However this information is not used in injury prevention.

Despite the existent information needs and justifications thereof, the information in use, is limited. Slight indications exist that this is changing, at least among the rescue authorities. Existing data on injuries and accidents are not in use. Data collected in hospitals and emergency clinics is retained as their own knowledge and not shared with the wider audience conducting preventive work. The data collected by national organisations do not reach local injury prevention practitioners either.

Information requirements change and extend in a rather short time period in injury prevention programmes targeting all ages and environments as the injury prevention activity, community programming and coalition building develops. The present study suggests that alongside medical care based data, models to measure safety behaviour and safety knowledge, as well as the means to collect data or get information on accident and injury circumstances, consequences and costs are needed at a local level. Information needs extend beyond mere injury incidence information to such areas as knowledge of safety, safety practices, long-term consequences and the societal cost of injuries.

Instead of investments in continuous data collection and building sustainable information systems for injury monitoring, short-term data collections on specific, narrowly defined injury topics are common. Local practitioners, however, indicate an interest in developing data collection methods. In order to do that they seek for approved and tested data collection models.

The present study suggests that two different aims exist to justify the information use. The first justification is to conduct evidence based injury prevention: to have data for planning and evaluation, to get feedback of one's own work and to conduct obligatory injury prevention and safety promotion work with an adequate knowledge of the injury situation. The second aim is that, in addition to evidence based injury prevention, local practitioners propose to use injury information as a practical tool for advocacy, to convince decision makers, to inform the general public, and also to educate staff while they are collecting data in order to improve the quality of services.

Barriers among local practitioners to conduct information gathering on injuries seem to include: limited knowledge of available injury data, a vague understanding of the data contents and weather the data can be accessed. Data utilisation barriers seem to be related firstly to the lack of organisational readiness and resources to work with surveillance data and secondly with the fragmentation of injury information in to several independent systems. Local practitioners do not talk of their own competences or knowledge regarding information systems as a barrier.

Data collection practice at the local level is highly influenced and determined by factors external to local organisations. National level regulations almost entirely define data collection at the local level.

8 Injury data collection in emergency departments

Local injury prevention practitioners in Finland have expectations towards health care organisations pertaining to providing injury information for prevention. Injury prevention researchers and experts also see injury registration and data collection in emergency departments (EDs) as one of the most important data sources for comprehensive injury surveillance in local community based programmes (Annest et al. 2008; Ekman et al. 2008; Spinks et al. 2005). It has been shown, however, that it is not easy to initiate and maintain a good quality injury registration system in EDs (Lund et al. 2004; Shipton et al. 2008; Simpson et al. 2003; Spinks et al. 2005). Studies from Norway (Lund et al. 2004), New Zealand (Simpson et al. 2003) and England (Ross et al. 2003) report low motivation for injury registration in primary health care and among General Practitioners.

The second approach is a study on the introduction and initiation of injury registration in two EDs. A case study was conducted to better understand obstacles, barriers and possibilities associated with the start and implementation of injury registration in EDs. The definition of the level of organisation is important – an organisation is a subsystem of something else and has subsystems of its own that could be studied as organisations in their own right (Hatch et al. 2006, 39). The level of organisation in this study was ED. One is located in a primary health care hospital and the other one in a specialised medical care hospital. Together these two EDs provide the public emergency care services for one Finnish municipality.

The study used multiple qualitative data and theory guided content analyses. Hsieh (2005) refers to theory guided content analyses as direct content analyses. The goal is to validate or extend conceptually a theoretical framework. In direct content analyses existing theory and frameworks are used to provide guidance and help to determine coding. (Hsieh et al. 2005.) The theoretical background is based on an analytical framework for diffusion innovation theory in service organisations presented by Greenhalgh and colleagues (2004; 2008). The framework is presented in the chapter 3.4.5. First an overview of the process of the injury registration is presented. Next the identified obstacles, barriers and factors supporting injury registration are presented using the concepts presented by Greenhalg and colleagues (2004; 2008) as a starting point.

8.1 An overview of the process

A comprehensive community-based injury prevention work began in 2000 in one municipality. No earlier studies on the initiation and implementation of injury regis-

tration in EDs exist in Finland. Starting injury registration was strongly supported by the municipal managers in the region. They highlighted that the local injury prevention programme should be based on data fully describing the local injury situation. To build up an injury surveillance system based on medically treated injury patients was seen as a necessary first step for the entire injury prevention work. Between 2000 and 2002 several meetings with the research team, made up from two national research agencies, and the city board of directors were held. The first project plans for financial grant applications were written and negotiations with municipality leaders, regional authorities, local representatives of the NGOs and key persons at the Ministry of Social Affairs and Health were carried out. By the end of 2002 financial resources for the first year were arranged, administrative structures for the project had been agreed upon and a project leader for the injury registration project had been hired.

In Figure 4 the general outline of the process is presented. Data collection began in the specialised medical care in 2004 and in the primary health care in 2005. Existing electronic patient journals were modified so that the injury specific data could be entered in the EDs as part of routine work while treating the patients. Injury registration terminated in both EDs by the end of May 2006.

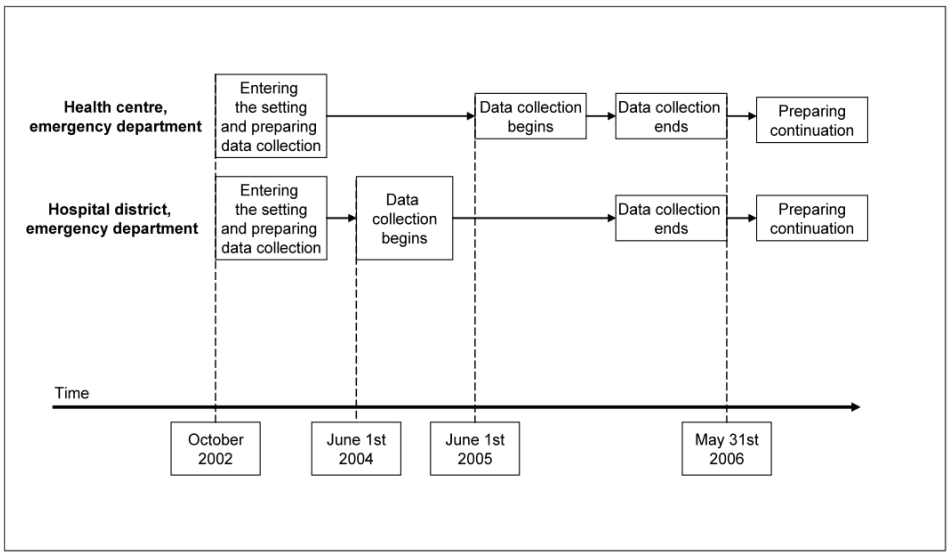

Figure 4: Main events and turning points of the injury registration project

In addition to data collection in the EDs, monitoring of injuries was also begun in elderly care, and children's day care settings, and later on in schools as well. Thus injury surveillance as a whole was comprehensive in the region. In the beginning the

project was totally financed by external funds in the form of grants from the Ministry of Social Affairs and Health. As the project went on a small share of the financing came from the local authorities. The obtaining of external funding enabled the hiring of a project leader and the implementation of the necessary changes into the existing electronic patient journal software. Data components in the injury registration included ICD diagnoses and external cause codes according to the Finnish version of the classification, including the type of injury classification. In addition, data on the use of helmets in bicycle, motorcycle and moped accidents, hip protectors in elderly falls and the type of sport in sports injuries were collected. The level of alcohol in every injury case was also collected. Injury registration was carried out as part of the normal work in the EDs.

8.2 Context

The ED in the primary health care organisation operated in a constantly changing environment in the region. Several changes occurred simultaneously with the project initiation and implementation. Firstly the primary health care municipal federation expanded: two municipalities formed the primary health care municipal federation in 2002 and by the end of 2006 the federation included five municipalities. This expansion brought in new decision-making bodies. As a share of the project funding came from the municipalities which were members of the primary health care municipal federation, the municipal contributions had to be negotiated with more local authorities than had been anticipated.

In the primary health care organisation the chief physician changed twice between 2000 and 2005. Every time the chief physician was replaced, the change was reflected in the development of the injury monitoring system. In addition the decision making role of the chief physician changed. At that time, when injury registration begun in the primary health care, the chief physician was both the administrative director of the municipal federation for the primary health care in the region and the medical director of the primary health care in the municipality. These two functions were separated during the project period. The chief physician continued to be the director responsible for medical and health care, whereas the position of the municipal federation's manager was appointed to another person. The decision making system prior to changes seemed to be better suited for change processes.

> *… the combination, that the head physician was both, (manager of the primary health care district and the head physician who answered for the activities of the health centre) was a really good thing, for this project it was most essential. … At the time, the head physician was surely also the manager of the primary health care municipal federation … he could make the decisions and all went well. (iv IV)*

Furthermore the outsourcing of emergency care personnel took place in the primary health care organisation. However, this change did not have such effect on injury registration as could have expected, since the resistance was lower among the outsourced personnel.

The temp doctors are not a problem, they do what is agreed. (iv VI)

A thorough reform of the electronic patient information system took place in both primary health care and specialised medical care organisations, including the EDs. This reform resulted in harmonisation of IT systems in the region. The software used in the primary health care and in the entire hospital district of specialised medical care became compatible with each other. Both the primary health care and the specialised medical care started to use the software products from the same IT system supplier.

Furthermore, outsourcing of hospital IT personnel and IT support occurred simultaneously with the planning and implementation of the injury registration project. Again, this change applied to both organisations.

In addition to local changes, national health and safety policy initiatives (Ministry of Interior 2004; 2006; 2008; Ministry of Social Affairs and Health 2000; 2003a) targeted at supporting local injury prevention and safety promotion activities took place. The main environmental elements are presented in the Figure 5.

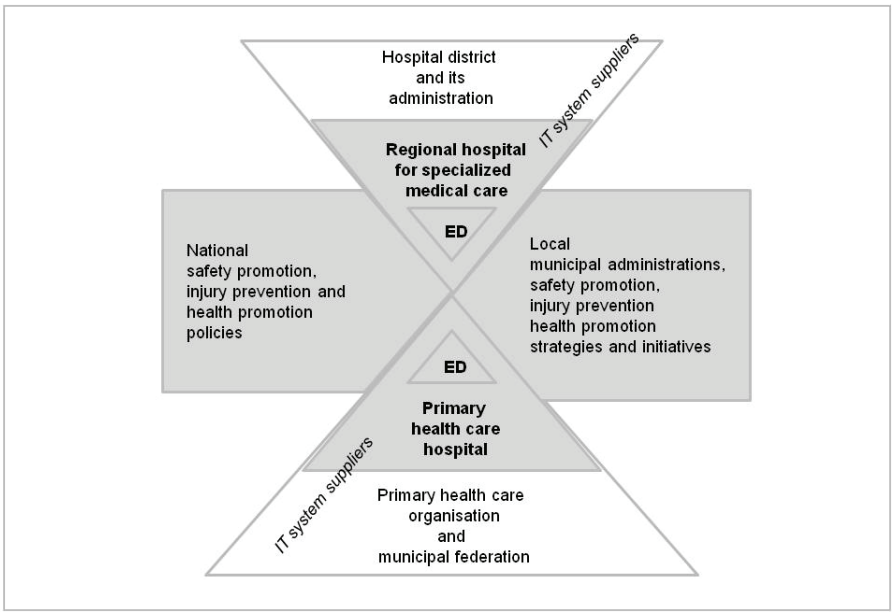

Figure 5: The environments of the EDs

The EDs were located in a municipality that had chosen safety as one of the strategic areas to be prioritised in the municipality's long-term plan. The municipality was developing a comprehensive safety strategy: not only to promote safety and prevent violence and injuries, but also to seek economic growth by trying to attract security industry business and education into the area. Supporting and facilitating the development of the injury surveillance system was in line with the municipality's long-term strategic goals. This alignment supported the initiation phase and getting started on the data collection. Without the commitment and support of the local authorities and municipal management, the project might never have been launched. Specific safety incentives at the municipal level were present which made the injury registration project appealing the municipal leaders.

> *First, there was this wider safety strategy … then it was later followed by this injury business …the ground was probably favourable for it, the environment was favourable for it … so this safety cluster or whole field of safety … strategically, for us it is an important section for development. (iv III)*

8.3 Organisational antecedents for innovation

Several characteristics of EDs seem to be important in explaining the injury registration implementation process.

Absorptive capacity for new knowledge. Absorptive capacity is defined as a combination of formal expertise, informal organisational know-how, technical infrastructure, and relevant interpersonal networks (Greenhalgh et al. 2008). In specialised medical care the technical infrastructure did not pose insurmountable difficulties and the implementation of injury registration occurred in a smooth and straightforward way.

> *Into that computer programme, the nurse always added such visit information, registered there also other information and at the same time, also opened a kind of injury page, where the nurse then registered those injury data. There was no need to put them there separately, but simultaneously with the other discharge data about the treatment of the patient. (iv IV)*

Even though data collection on injuries was a new work task in the specialised medical care situation it was seen rather as "business as usual".

> *clearly, in the specialised medical care, there was such a tradition that the personnel fills in a lot of stuff anyway, so there it was not a problem at all. They only sort of widened the basic data field, which was created there and started to fill it. (iv IV)*

Existing work practices to introduce new tasks supported the implementation process. The interpersonal networks and communication culture among the nursing staff seemed to support the implementation of injury registration. It helped to gain a common understanding of the principles underlying the classification.

> *…It was discussed in every shift … When new nurses came, who hadn't been there earlier, it was then discussed … (iv II)*

> *… but for instance if someone falls over at his summer house, is it then a home injury or a leisure injury …so they are kind of checked over, and a common practice is then decided … so if new cases appear which lead to confusion they are recorded so they can be gone through again and it can be seen where they actually belong. (iv I)*

The absorptive capacity for injury registration in the primary health care situation was different. Collection of data on diseases was not a tradition and the IT systems were not geared to support that kind of data collection. Instead the system allowed thorough registration of medical procedures carried out by the physicians and other staff.

> *In a district hospital (specialised medical care hospital) it was obviously a tradition that the personnel register a lot of stuff anyway so it was not a problem there. … primary health care was kind of virginal … In principle, they have never registered any such diagnoses, injury or disability diagnoses or similar … there has only been these visit statistics … like statistics as an activity it has not been prioritised very highly as an interest. (iv IV)*

Leadership and management capacity. Primary health care organisation and municipal administrations work closely together in Finland. The decision to champion a comprehensive injury surveillance system was supported by the municipality's management team and the municipal manager. The fact that the management team systematically proceeded with actions and subsequently resourced safety activities and programmes according to their long-term strategy plan, strongly supported the injury registration initiative in the initiation phase. The information was required for better informed safety promotion. The management team decided to invest personnel and financial resources to support the initiation and implementation process. There was

both impetus and support from the municipality authorities to initiate the injury registration in the region.

> *I said that I can take over this matter so it gets started. And I got the support (from the municipal manager) and then the work started through the work contribution of the project leader. (iv III)*

The primary health care organisation's chief physician subsequently took over responsibility for the project and later became an important support of the project. The straightforward management and decision making style of the head physician was identified by several interviewees to be vital for the project initiation and later on for starting data collection in primary health care.

> *Suddenly, we just attended a meeting where the head physician (of primary health care organisation) was, too, and he said that from now on the health centre will administer this, so it was decisive. … generally, the head physician saw everything in a straightforward way. It was his strength. (iv IV)*

> *and, oh, he (the head physician) took the matter as unremarkable inside the health sector. Like without fuss … all the time it felt like he didn't take any stress from it, rather he took it as one matter among all the others. (iv III)*

In the specialised medical care environment the decision to begin injury registration was made at the hospital level. The administrative decisions were hardly discussed by the interviewees and as will be seen later the decision to initiate injury registration was not considered as a big change. After the decision to initiate injury data collection, it was the task of the directors of nursing to carry on the process, with the support of the project leader. The head nurses impact on the success of actually starting to register injuries was significant in both EDs.

The leadership and capacity of the project leader, in both management skills and expertise, was important. In addition to a systematic, goal-oriented way of working, the project leader's injury expertise was noted by many interviewees as being extremely important.

> *… one quite essential reason for why something happened for us was the project leader of the project. He has been able to guide the project RESOLUTELY. He has been quite a huge factor in this.(iv VI)*

Clarity of organisational structures. Community based injury prevention concerns many organisations. A clear decision on where the project organisation was placed

was important. In this particular case the project organisation was placed in the primary health care organisation which then provided the administrative structures, services and resources for economic and personnel administration. The project was considered as a developmental project in the primary health care organisation. This meant, for instance, that in practice the primary health care organisation was an official party to any agreements. The steering group and work groups were all nominated officially. Clarity of organisational structures supported the project leader's work.

Risk taking climate. A risk taking climate is one in which experimentation is encouraged (Greenhalgh et al. 2008). In the specialised medical care the injury registration did not require for any risk taking.

> *in a way, it is everyday life, part of the work to take part in these different projects (iv I)*

However, the situation was different in the primary health care. The enthusiasm and risk-taking ability that was noticed in the recently hired head physician was not a general feature in the ED. The risk taking climate in general was low. Expansion of the primary health care municipal federation occurred simultaneously with implementation of the project. The difficulty in recruiting physicians and their high turnover, as well as identifiable fatigue linked with constant organisational change and a lack of adequate resources, seemed to be associated with a low risk taking climate in the primary health care. Contextual factors of the organisation to which the ED was a subsystem was a challenge to the injury registration process.

> *… the new head physician (in primary health care) was ready for everything new and wanted to lead this house to something new. (iv VI)*

> *and then there was this tumult. … that tumult of change. All this … (injury registration), certainly it felt somehow extra. (iv VI)*

Slack resources. Organisational slack is a term used to denote spare time, money or expertise that can be channelled into new projects (Greenhalgh et al. 2008). In the primary health care organisation the staff turnover was an obstacle and was associated with minimal spare time for preparing for changes. The allocation of resources for the project was problematic and it proved difficult to involve physicians in the planning,

> *…the doctor situation started to get really bad. It deteriorated so drastically and the doctors felt that we will surely not fill in such data collection sheets. (iv VI)*

In the specialised medical care personnel turnover was minimal and this may be one factor associated with a smoother change process.

> *Yes, it is fairly permanent here (in the specialised medical care). The nurses are the same. Yeah, as a rule they are permanent. (in VII)*

Furthermore, the pace of work seemed to better allow for injury registration in the specialised medical care than in the primary health care situation. It is possible that nurses have more time with each patient and the physical environment, including the number of computers per nurse may ease the pace of work.

> *actually, they (injury registrations) were made in real-time (in the specialised medical care) at that time, yes, in real-time. So when the patient left, then. ... Meaning that it lasted rarely more than an hour when they were done. … It is done simultaneously; you don't have to go there specifically. (iv II)*

The lack of time -complaint was significant in the primary health care organisation.

> *there was no time to check the sheets and then the personnel became frustrated also because they did not have time enough to fill them in carefully. … (iv VI)*

8.4 Organisational readiness

Innovation-system fit. Innovation-system fit refers to the degree of alignment between the organisation's wider development goals and the introduction of a specific innovation (Greenhalgh et al. 2008). Injury registration was in alignment with the expressed need to develop more informed public health practices in the region. The matter was brought up in particular in the primary health care organisation where the need to improve information for planning was mentioned by the director of nursing and by the head physician.

> *we should see the work in such a way that research and data collection will be (the future), all the information we can ever get, we should be able to utilise it all. (iv VI)*

Injury registration was in line with the desire to invest more into evidence-based health promotion in the area, both in the primary health care and the specialised medical care organisations.

> *And along with this project, this preventive work, also regarding fractures, it has progressed substantially in my opinion … actually, it has brought us quite a lot of such new things. So, earlier we haven't had an osteoporosis nurse but now we have. (iv VI)*

Furthermore, alcohol related health problems were above the national average in the region and there was an alignment with injury registration, injury prevention and prevention of harm caused by alcohol use.

> *Such as alcohol and injuries are quite often related. … especially here, use of alcohol and alcohol disorders are much more common than in the country as a whole. (iv V)*

The excessive number of injury patients and numerous types of injuries was a challenge to injury registration in the primary health care organisation. The patient population in primary health care differs from that in specialised medical care. The innovation system fit is weaker in primary health care than in specialised medical care.

> *There were so many of them (injury patients). … , from babies to grandparents came to us (primary health care outpatient clinic). … so it is different in central hospitals ... The group going to the central hospital was already selected. So the smallest stayed at the health centre ... so there (the material in the health centre) was everybody, all the nicks are noted there, all the old people's violence, all such things which you can imagine ... Well, I would say that the patient material is much more multi-faceted in a health centre. (iv VI)*

Tension for change. Tension for change refers to the extent to which people are uncomfortable with the status quo and feel that something has to change (Greenhalgh et al. 2008). This is to some extent supported by the data. In the primary health care organisation some physicians and the senior nurses felt that it is important to know, not only the number of patients but in more detail the reasons for health care visits. Injury registration was seen as a step in the right direction. For a long time counts of patients and bed days, and other similar data, have been used to describe primary health care activities.

> *The starting point of the plans for the public health work was that the visits are carefully registered. That was the only thing which was recorded, the visits at the outpatient department, in the environmental health care or days at the long-term care department or how shall I put it, at that time we still called it the bed department. These were the*

> *only objects of interest … In this injury recording, we have actually now gone into the background, and not only considered how the situation could be corrected. … to these reasons, but they have been, they have not been objects of interest in these emergency departments. (Iv III)*

Tension for change was not a common experience in the primary health care. Some members of the staff were enthusiastic about developing information systems to gain better understanding of the patient population and wondered at the lack of interest in data collection in particular among physicians. For some injury registration was extra work.

> *… still it is so that must we collect this information non-stop … So people surely got bored with the data collection. (iv VI)*

In the specialised medical care the tension for change was not significant and injury registration was not considered as a new task to be performed. Injury registration was simply one activity among former, existing and future data collection practices. A need to develop procedures was not specially emphasised. Injury registration was rather seen as ”business as usual”.

Balance of support. The resistance in the specialised medical care was not strong among the nursing staff.

> *Well, in my opinion, the acceptance like in the group has all the time been kind of quite good, that there is not, that nothing came from there like oh no, this kind of stuff again. (iv I)*

In the primary health care organisation resistance existed throughout the project. The support from people in strategic positions, such as the municipal leaders and chief physician, was important.

In both EDs the injury registration ended when a renewal process of the IT software for electronic patient journals took place. The renewal meant harmonisation of IT software. The primary health care in the region and specialised medical care in the entire hospital district were to use compatible software from the same software producer. Having the mandatory data fields for injury registration in the two EDs became a matter concerning the entire hospital district. A local IT company was used in a “middleman” function between the software producer and health care organisations. Independent decisions that were previously made in the hospitals and emergency clinics regarding the software were no longer possible. In the new situation the opponents were in the IT company and hospital district and outnumbered the supporters.

… those who have been like in such a position that they should have intervened have not necessarily done that, (iv I)

There was such a phase where the data system supplier was not willing … to put them there (the injury data collection parts into the data system). … they said that they were short of resources, that they didn't want that data collection. (iv VII)

8.5 Concerns of potential adopters

Analysis and utilisation of data was one obvious concern. What happens to data, whether it will be analysed, by whom and for what are all important. Previous experiences of data collection without any actual known data utilisation were described by the interviewees.

There is a plenty of examples of data collections, about which nobody knows where they come from and where they go to. (iv VII)

… I get all these statistics and research results. And when I have then offered them here and there, there were very few takers. (iv VIII)

Use of a breathalyser on every injury patient to measure alcohol use was planned as a mandatory part of the injury surveillance. This procedure was new for the nursing staff and they felt uneasy with it. In both EDs the procedure caused a great deal of concern.

One thing which felt embarrassing was the plan to breathalyse everybody. So, for instance with a child, it is a little embarrassing measure. Awkward … (iv III)

… the nurses are too embarrassed to ask. It is not a routine ... I don't know why it is considered so difficult … They can measure the blood pressure but not breathalyse (iv VIII)

Some staff members interviewed indicated, however, that it is easiest when the breathalyser test is a procedure conducted with every injury patient. Physicians, however, expressed that the alcometer reading is necessary information and should be collected with every injury patient. Some nurses felt that a breathalyser should only be used when necessary for the treatment. Reasons for concern were many, including embarrassment, the fact that the measurement may not always be accurate since the breathalysers are not regularly calibrated, and that for some patients a posi-

tive test result may affect their career. Further reasons were that ethyl alcohol is a commonly used substance for cleaning in hospitals and can affect the breathalyser test results, it is difficult to conduct the procedure with violent patients, and privacy issues: the procedure cannot be done without other patients around hearing it.

The role of hospitals and emergency clinics in injury data collection in general was discussed to some extent and was a concern to some. Some of those interviewed in the primary health care organisation argued that the cause of injuries data should not be collected in the health care, but at the place of occurrence.

> *This started with that in the health care organisation there was an attempt to compile statistics on injuries more carefully than before, different causes of injuries and factors related to them, and very soon it became clear that this is difficult or impossible. These injuries are not generated in the health care, but really elsewhere. They originate in schools, day nurseries, elderly homes, service centres and so on. And the data related to the injuries should be collected there, too. (iv V)*

Both physicians and nurses were concerned at the level of data elements and detail of the classification and also about the personnel resources and how work time is spent at EDs.

> *…there will never ever be enough time for the physicians or nurses or anybody else to ask, to register every helmet and slippery conditions and the rest. … filling in, besides the normal medical record statistics, one to three data fields is like a maximum. (iv V)*

> *If we go in for a continuous data collection, what we can collect is a very limited amount. … Research use is quite another thing, it requires separate collection of data. (iv V)*

Previous experiences with IT system modifications and reforms seemed to discourage personnel, provoke concerns and lower willingness for changes in both emergency clinics.

> *… you know, health care IT systems are sold as a concept, there's never any off-the-shelf product, and it's always jury-rigged by amateurs on site, it's never designed from a user-oriented perspective; and although people do engage in development and make submissions to the software supplier, it's often the case that when a new version comes it lacks precisely the features that you wanted and has all sorts of features you never wanted, and then they say isn't this nice, and*

then you try and live with it so that it disrupts your work as little as possible. (iv V)

One concern that may also affect the willingness to support projects like injury registration is that administrative work and the time spent with computers instead of patients has increased.

… certainly we like take care of the computer almost as much as the patient … so nursing is like that nowadays. So you tap on the computer as much as you nurse the patients. All kinds of other registrations are made there … and made ever-increasingly. (iv II)

8.6 Communication and influencing people's decisions

Training sessions were carefully planned and organised in the injury registration project. Efforts were made to reach as many data entrants as possible. The aims of the training sessions were to motivate the staff and to inform them how the data will be used for injury prevention in the region. In practice organising staff training was challenging and the influence of the training is difficult to determine. In the primary health care organisation, where data entrants were more often physicians, the training was offered to the staff by an experienced physician. It was said that the education for physicians did not succeed well enough to affect their motivation. Education for physicians did not seem to be sufficient to overcome the expressed resistance.

(A doctor) trained all these doctors…certainly they pretty much cried foul and said, why is this done, how does this benefit us … but somebody understood … in any case, they didn't buy it like at one go. And, at the end of the day, the other staff did the registration, the doctor was just supposed to give the diagnosis, and the diagnosis is missing in a very large part of it. (iv IV)

In the specialised medical care, where nurses seem to play a more important role in data collection, training sessions for the nurses were organised. In addition, one nurse was appointed to be responsible for the project and was charged with organising additional support during the daily work. The head nurse held motivational talks with the staff prior to the injury registration. In these sessions the value of data collection was discussed.

It just had to be justified to those personnel, … And then to frankly tell how it increases your work. But then what, why would it be kind of valuable to do. … Then, after discussing with the personnel, yes, many

of them said that when we get results, we will understand this. And, yes, then they just began to wait for it. (iv I)

In the specialised medical care only some nursing staff members attended educational sessions, since it was difficult to find suitable times for all to attend. However, routines like information sharing on bulletin boards and in staff meetings worked.

yes, and certainly we have had such training days or afternoons … but, again, there is this problem with them that it is difficult to get people to the training days, you don't get more than a certain number of people … No, actually we can't spare … (iv I)

… when I came to work, the noticeboard told about some injury project … it was discussed in every shift … whenever new nurses came there, who hadn't been there before, it was then discussed mouth to mouth. (iv II)

Active dialogue and interaction with an enthusiastic project leader were found to support the injury registration learning process in the emergency clinics.

(the project leader) has been so enthusiastic that he has had the energy to drive the project and been in constant contact with us. (iv II)

8.7 The implementation and routinisation process

Injury registration lasted for two years in the specialised medical care and for one year in the primary health care organisation's ED. Injury registration terminated in both places when a total software renewal became an issue in the region. Injury registration had not yet become an established practice in the primary health care organisation.

Appropriateness of change model

The change model included the decision of the injury registration content, revisions of the electronic patient journals so that the data entering would be part of every day work, education and support of the staff participating in the data collection. At the beginning, in the pilot phase it was not possible to do the injury registration electronically in the ED of the primary health care. The content of the planned injury registration was pilot tested using a paper format. A widespread resentment existed, especially among the physicians.

and then there could be lots of tickets … when thinking of the emergency department, what the patients in the emergency department of a

> *health centre could be, they were during the summer mainly these injury patients and, but that we could have over twenty tickets on the table and something must be written on each of them. So it felt that also the staff got tired of it, (iv VI)*

The communication between the project leader and staff in the planning phase in both EDs, education and frequent informal meetings and discussion sessions during the implementation phase was pointed out by the interviewees as being important.

The process of change of the software occurred smoothly in the specialised medical care. Changes were carried out locally and personnel resources were adequate to support the change process in the specialised medical care ED.

> *… Then, as we began to get experience, there was naturally this follow-up … it was checked what information was missing and training was increased and there was still an attempt to change the data system. It was also noticed that, even though it had been carefully planned what data is collected, changes had to be made to this, too … so the analysis of the result would be simpler, so it wouldn't be open to interpretations. Such changes were made along the way. (iv VII)*

Effective project management

Clear goals, realistic milestones, efficient delivery and coordination, and attention to follow-through are well established elements of the success of any project (Greenhalgh et al. 2008). The project was managed well, steering group meetings were regular and well prepared and following up the project's progress was easy. This was brought up by the interviewees and was observed by researcher during the visits in the region. There is no doubt that effective project management supported the accomplishment of the targets.

Autonomy of front line teams

One of the characteristics of this case was that the project leader was given a free hand to act.

> *… here, a competent and productive project leader who possesses new visions is given sufficient freedom to start to develop and carry forward the project, so these successes, which we have with this project, are very much personified in that project leader and also very much in these kinds of scientific ambitions of his. (iv V)*

> *nor has the frame of the project harassed us too much, but we have then been able to move also to places we hadn't even thought of in the beginning of this project. (iv V)*

Human resources

Successful implementation of an innovation generally depends on recruitment and retention of staff with key skills, knowledge and credibility (Greenhalgh et al. 2008). A key factor for success mentioned by many interviewees was successful project leader recruitment. Several interviewees pointed out the importance of expertise of the project leader in especially in the injury field.

> *… so there has been a person who does this job, and like believes in it and shows it. And using common sense, clarifies why it is done in this way, which is very good. (iv VI)*

> *… so these successes, which we have with this project, are very much personified in that project leader and also very much in these kinds of scientific ambitions of his. (iv V)*

The skilled and competent nursing staff also played an important role in the preparation and implementation phases.

The human resources and capacities of the IT personnel in the software companies, the intermediary IT company and the hospital, on the contrary, were insufficient and discussed widely during the interviews. Lack of software resources was clearly one big obstacle and a source of frustration. The IT personnel resources representing the hospitals were inadequate. Doubts on the adequacy of their skills were brought up in the interviews.

> *In a way it was not possible to find like such persons who would be capable of like taking it, or like they always said, no, this is not going to work. (iv IV)*

> *In my opinion, this kind of persons are not taken to that (intermediate company), taken or recruited such real experts in so great numbers … They are all nurses or that level, so how could they know about these (software technology) matters. (iv IV)*

In addition, lack of IT human resources was identified to be one factor among others associated with the termination of injury registration in the region in May 2006.

> *I have the impression that the biggest problem there has been is that the software producer hasn't been able like to organise it … In other words, I have the impression that the software producer wasn't able to do it and then they didn't want anybody else to take over. (iv I)*

The alignment of routines

A determinant of successful innovation is whether the new routine associated with the innovation aligns rather than conflicts with existing organisational and inter-organisational routines (Greenhalgh et al. 2008). The injury registration did not conflict with work practices in the specialised medical care as much as in the primary health care organisation. In the specialised medical care injury registration became part of every day work easily, as was earlier described.

> *… then, of course, what was after the piloting, it was quite a practical approach, so nobody actually questioned it anymore why we do such work or such unnecessary work, it was just done. (iv I)*

As a matter of fact data collection in the specialised medical care had become as a routine task in two years. It surprised nurses that the renewal process of the software terminated injury registration.

> *when this new computer system was introduced, we had the impression that we can go on like before also by using the new system. We imagined that it is just better and more developed and that the statistics can be compiled even better with it. But, this could not be done at all. (iv II)*

The ED in the primary health care organisation differed significantly from the specialised medical care. It was not customary to record the reason for patients coming for an appointment or for seeking treatment or their diagnoses in the primary health care organisation. Since the injury registration was intended to cover the entire municipality, the use of the same classification in both EDs was important. At the time when the injury registration project was implemented in the region the ICD coding system was not used in the primary health care. Instead a classification specially designed for primary health care organisations was in use. Since the identification of injury treatments was not possible in this classification, it was decided, that for injury registration ICD codes including the injury specific codes for external causes of injuries and type of injury coding would be used in both EDs. Specially in the primary health care the use of ICD codes proved to be difficult.

> *And now, when I have thought of this process and discussed it with doctors who worked in the health centre. In fact, they say that in health centres, putting in diagnoses is quite a difficult problem … that the ICD 10 doesn't serve them terribly well. (Iv IV)*

Also at the ED in the primary health care organisation, as in the specialised medical care, injury registration was planned to be performed as routine, during the treatment

with each injury patient. However, in the primary health care ED, both nurses and physicians treated injuries. The injuries nurses treat are minor cuts, bruises, etc. Some interviewees expressed the opinion that the injury registration system could not be the same for both.

> *In addition, this data collection is related to such a feature or peculiarity as the ICD 10 diagnosis classification – it is precise and in it these injuries and external reasons are diagnosed. So it is possible to register them as numbers. But it is so detailed and cumbersome that it is not suitable for nurses at all, instead it always requires a doctor, and in these small injuries the nurses just glue together cuts and nurse. (iv V)*

The division of duties between nurses and physicians is changing. This general development that affects daily routines played a role in injury registration implementation process as well. The physicians especially in the primary health care raised the issue of increased clerical work. But the interviewees in specialised medical care also remarked on how the changing division of duties affects the work. Previously nurses always did all the data entry and doctors never performed this task. The nurses took responsibility for entering the required data to the patient records – including "running after doctors to get diagnosis data". In the new IT systems the data entered by the physicians seem to be increasing.

> *What is happening is that the doctors' work is being taken over by nurses, the nurses' work is being taken over by department secretaries, and the department secretaries' work is being taken over by physicians," ... "It used to be that the nurses wrote everything up and the physician just signed it. (iv V)*

8.8 Linkages

Based on the interviews several linkages can be identified as important for injury registration. First of all the link between the injury registration project leader and the administration department within the primary health care hospital (1), secondly the link between the project leader and the municipal administration (2) and thirdly the rather tight organisational connection between the primary health care administration and the municipal administration (3). All the linkages were necessary and formed a supportive structure for the injury registration project.

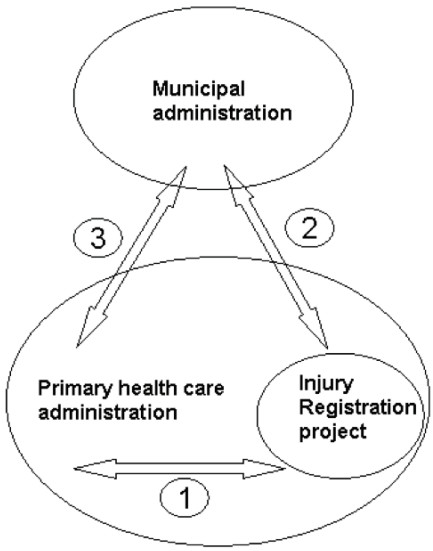

Figure 6: Inter-organisational linkages between the Injury Registration project, Primary health care administration and the municipal administration

The link between the injury registration project and the primary health care administration worked well and seemed vital since the project administration was placed in the primary health care organisation. The primary health care chief physician was also the chairman of the project's steering group. The link was most likely further strengthened by the fact that injury registration in the primary health care encountered relatively strong resistance, requiring a large amount of work and special attention.

> *There have been three people who have found common ground within the organisation: the chief physician, the director of nursing and the project manager. (iv III)*

The link between the project and municipal administration seemed vital as well. It supported the process of getting started and carrying on the implementation process. The municipality's management team was the initiator of the project and thus had an interest in following the progress of the project. As the project had started a dialogue between the project leader and an experienced officer of the municipality supported the registration project. The officer was appointed by the town manager, with working hours allocated to facilitate and support the initiation of injury registration. This strong link between the project and the municipal administration was identified as important support in the early phases of the project. The link was further strengthened by three factors: firstly the fact that the superior of the primary health care chief physician was a member of the municipality's management team, secondly all

municipalities had representatives in the steering group as the primary health care municipal federation expanded during the project period and thirdly all municipalities also paid a share of the expenses. Thus the triangle that includes the project, the municipal administration and the primary health care administration, were vital for the injury registration. The involvement of the top levels of leadership in the separate organisations was identified as important.

The link between the injury registration project and the administration of the specialised medical care hospital district was different in many ways. The hospital district's top level of leadership (5) was less involved and their participation in the decision making of the project was limited. The specialised medical care hospital (4) in the municipality was able to make injury registration decisions quite independently from the hospital district administration.

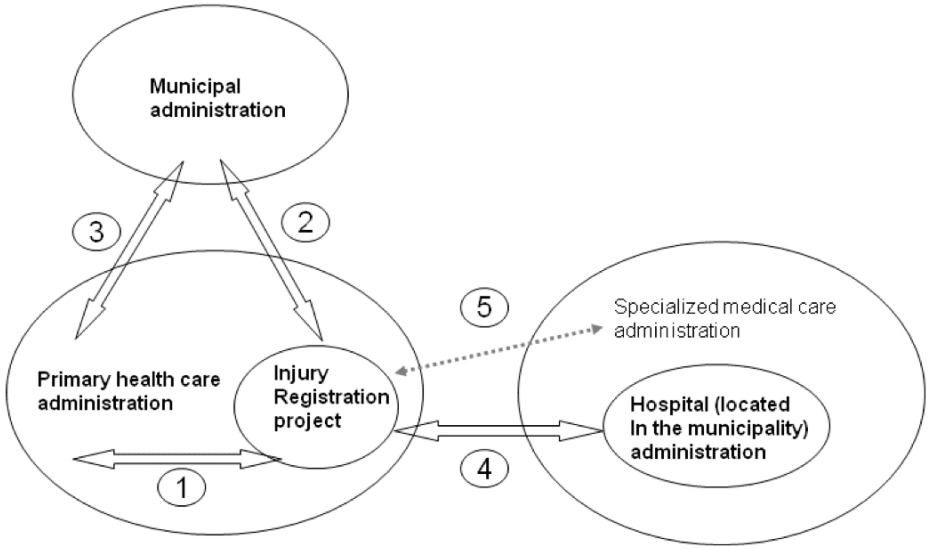

Figure 7: The inter-organisational linkages between the Injury Registration project and the specialised medical care administration

The concept of anchoring investigates the permanence of change, where anchoring-up means integrating changes into the planning and practices of the higher organisation levels. Anchoring-down means implementing changes into everyday work and anchoring sideways means gaining support for change from co-operative partners. (Kerosuo et al. 2006.) The injury registration project was anchoring-up more tightly within the primary health care than within the specialised medical care hospital district. The strength of anchoring became important when the electronic patient journal renewal process took place in the region. The change applied to all specialised medical care hospitals in the entire district including the EDs. The

change included also the primary health care hospitals and EDs participating in injury registration project. The one specialised medical care hospital, in which injury data was collected, was no longer able to continue locally defined data collection.

The decisions made in the hospital district administration played an important role since they had an impact on data field decisions that exceeded those defined as mandatory by national actors. Injury registration in the area included data collection such as the use of safety equipment, the blood alcohol concentration and type of sport while injured, none of these were nationally mandatory data fields. Neither were ICD codes required in EDs at that time. Data fields for injury monitoring, not required by national authorities were excluded from the new software. This decision terminated injury specific data collection in the region for several years.

Other important links were those between the project and IT companies and IT personnel in the hospitals. The outsourcing of IT personnel in both primary health care and specialised medical care organisations was one of the contextual attributes affecting the project and meant a widened gap between the injury data collection project, IT support, the software firms and also between the end users and software developers in the software company. An IT company in-between became an intermediary, a decision maker and a significant player in the process for changes. The IT company in-between communicated with the third party that actually supplied and modified the software. This chain of negotiators had an impact on the process.

> *There's the IT service in between [i.e. between the software company and the hospital], I talk to them … My hands are tied by this intermediary, and that's what irritates me. (iv IV)*

> *… when we began to make changes to the primary health care system, it wasn't even clear who I needed to talk to. It was difficult to comprehend who should be invited to the meeting. Everyone just ran away. Nobody from the IT crowd wanted to have anything to do with it. The support we got was really lame, we just got together every now and again. (iv IV)*

> *So the communication chain required ... when something should be changed, it is awfully long. (iv III)*

Furthermore, it was apparent that outsourcing also increased the injury registration project's expenses. For even the smallest change the costs easily spiralled out of control because of the many middlemen involved.

> *Every time they do anything from me to them or them to me, they bill for it ... and it's a lot more expensive than we thought. (iv IV)*

Local planning means planning together with the data entrants and other health care personnel doing the actual injury registration work at the ED with the program. Remote planning means design, modification and developmental work done by the software firm. (Norros et al. 2007.) The co-operation and strong interface between local and remote planning has been pointed out to be one key element in succeeding in developing user friendly IT systems (Norros et al. 2003; Norros et al. 2007). Within the injury registration project the tenuous interface between the local planning and the remote planning became an obstacle. The interface was actually almost non-existent. This subsequently complicated the process and most likely affected the end result of any changes.

The methods used in planning the technical features of the application alteration were not transparent to the end users during the preparation. The negligible or non-existent functionality of the user interface was at least partially associated with a nonexistent link between local planning and remote planning and this was further reflected in the end product of the application. Good and productive ways of working with the software firm were not easy to perceive and difficult to master.

> *the information systems of the health care … they are designed in principle quite somewhere else, and not as user-oriented. ... suggestions are given to the information system suppliers, but very often it happens that when a new version arrives, it is not precisely what we asked for, (iv V)*

It was obvious that the parties in the planning process spoke different languages. One person with a health education background described discussions with an IT educated person:

> *They just spoke in jargon, and I didn't understand it at all … I went to see this one guy who talked and talked and I didn't get much of anything. (ic IV)*

The software used in the specialised medical care was different from that in the primary health care and the software firm was not one of the major health care software producers at the beginning of the project. The change process was smoother, even though the IT personnel were outsourced as in the primary health care. The link between the hospital, the intermediary IT company and the software firm worked well.

> *it was already somewhat discussed, what kind of changes are made to the information system, that it will be comfortable for the user to fit it into the registration of the patient visit data. … Then the IT company, which made these system changes, it went in a normal way through a process of change, i.e. a presentation was made and it was then tested*

in a make-believe environment, a training-testing environment. The results were explored, and particularly with the emergency department of this district hospital, their active doers participated. (iv VII)

8.9 Physical environment of the emergency departments

The limitations of the EDs' physical environments were brought up in the interviews. The physical environment proved to be an obstacle particularly in the primary health care. When the electronic injury registration started the limited number of computers in the ED was a barrier and caused extra work. Also the fact that computers did not exist in the same room where the patients were examined and treated caused some extra hassle. During busy times, nurses had to scurry around from one patient to another. They had no opportunity for entering patient information in the IT system while talking to patients. The nurses' computers were in a cubicle that had to accommodate several nurses at once. The nurses had to memorise the patients and their treatments, since often it was not until the end of their shifts that they had an opportunity to enter the data. Several nurses had begun using paper forms to write down all the information and then enter it in the patient record system at the end of their shift.

But that is exactly the problem, that the electronic data collection is a bit difficult, because there are only a certain number of nurses and only a certain number of machines open, and so they would remember the data collection and other stuff, they were usually printed for each patient then … and filled in first by hand (iv VI)

when there is an injury patient, he is in the first aid room or in such observation places with no such machines. So it is running all the time … So I think it was a considerable obstacle that there was not like time and peace to collect that information in that way and put it directly in (the computer), instead, the interview had to be done anyway and then you had to go to tap it in. (iv VI)

Nurses felt uneasy to use the breathalyser and the physical environment of the EDs did not support nurses in that. The procedure was done in space where there was no privacy. Other patients could easily hear the results.

Expectations for future developments of the technology were discussed. The interviewees raised the issue of greater automation and of communication between devices, for instance so that the result of a breathalyser test could be immediately wirelessly transmitted to the patient record system. At present, these data are always entered manually.

> *Actually, in the health care, we have particularly different measuring devices. Blood pressures, blood sugar, all kinds of monitoring devices. From none of these monitoring devices, neither along a wire nor wireless, do these data move to our case history systems, as they should move. (iv V)*

Furthermore, the patient waiting time ought to be used so that the patient is able to enter information themselves concerning the injury if possible.

> *So in the future, we probably have to focus on that the patients themselves give more information about themselves, if they are only able to do so in some way. (iv VI)*

8.10 Properties of the technology

The properties of the technology used for injury registration is of key importance.

> *Even though here is a kind of attitude, attitude level and motivation level thing, but here is also something terribly crucial, this how the electronic patient data system works. (iv IV)*

Once the changes were made the end result was a major source of frustration and complaint in the primary health care organisation.

> *… the patient comes to the doctor, the doctor treats and checks, and then the doctor puts the diagnosis data on this paper which is going to the insurance company. The same information the doctor puts in the statistics part of the case history, and the same information in the injury follow-up system. (iv V)*

Convenience of work and easiness of use of IT systems are influenced by the user interface features. The interface of the software used in the primary health care organisation was described as being not user-friendly. This made data entry a time consuming and frustrating work activity. The end result of the application after changes was described as unfinished and also became a possible source of errors. The space of the fields reserved for labels of the variable values in the interface was too short. The labels were not completely visible when the data was entered. Yet the ends of these labels were crucial: e.g. ‘fall on the same level involving ice and snow’ or ‘fall on the same level from slipping, tripping or stumbling’. Finally, producing reports proved to be problematic in the primary health care. This was a general problem of the software used in the primary health care and not specifically related to injury registration only.

If we at least got from there (the data systems) what we must get, i.e. what we need for instance for the municipal invoicing, … so, it has been sheer fighting. (iv VII)

8.11 Summary of results

The EDs in the specialised medical care and in the primary health care organisations provided different contexts for the implementation of the injury registration. The EDs differed in many ways in their preparedness to adopt injury registration.

In the specialised medical care a low turnover of the personnel, a tradition of collecting data for research and administrative registers for statistics on diseases and established procedures for introducing new practices, such as the injury registration, supported the implementation process. The ED in the primary health care organisation was a turbulent environment and the identifiable fatigue linked with constant organisational change lowered the willingness to adopt new procedures such as injury registration. In addition, in the primary health care organisation it was not customary to record the reason for patient visits, whether coming for an appointment or to seek treatment, or their diagnoses in detail. Diagnoses codes for patient visits in the primary health care have not been customary. Many of the visits are not due to an acute illness and diagnosis codes are therefore not appropriate.

The patient populations of the two organisations were different. The excessive number of injury patients, some of which had minor injuries treated by nurses only, lowered the willingness to adopt injury registration in the primary health care organisation.

The pace of work was also different. In the specialised medical care, the nurses pace of work made it possible to perform the data entry during or just after the care of the patient. This seemed to lower the threshold to accepting the new task. Contrastingly, in the primary health care organisation injury registration did not align with the daily work routines. During busy times nurses had no opportunity to enter patient information in to the computer while or after treating the patient. Some nurses began to print the injury registration forms and did the data entry at the end of their shifts.

Furthermore, software products and technology were different. The software used in the specialised medical care was a product from a small company to which it was possible to make changes at the local level. In the primary health care organisation the software product was not efficient for application development in response to local needs. When changes were made the end result of the application was not satisfying. It was described as unfinished, producing reports proved to be problematic and the interface was not user friendly and a possible source of errors.

Different socio-cultural factors seemed to be associated with the initiation, implementation and end result of the implementation. The culture of introducing new tasks and discussing concerns with each other supported the implementation process in the specialised medical care organisation.

Management and leadership and additional financial resources also appeared to be associated with the adoption of injury registration. In the primary health care organisation, resistance to adopting injury registration among physicians was high, requiring a large amount of attention. This process required the determination of the managers of primary health care organisation and the community to adopt injury registration. In addition, the project leader's and the chief physician's straightforward and systematic management style and negotiation skills supported the implementation. In the specialised medical care the decision to begin injury registration was made at the hospital level without any major negotiation process and without the hospital district directors' major involvement.

The fact that the project organisation had a clear organisational structure seemed to support the implementation. The thorough injury specific knowledge and injury research experience of the project leader was identified by the interviewees as strongly supportive of the initiation and implementation processes. In addition, the fact that the project leader was given a free hand to act seemed to smooth the implementation process.

The alignment between the injury registration, public health concerns and the primary health care organisation's developmental goals seemed to support acceptance of the injury registration process. Organisational readiness to participate in injury registration in the primary health care organisation was apparently increased by two factors. Alcohol-related harm and diseases were more common in the region than in Finland in general. Secondly, information on patients for the development of the primary health care organisation's services was valued highly by the chief physician and the health nurse.

Some features of the injury registration model were common concerns in both organisations. The complexity of the ICD external codes proved to be difficult. However, the model using ICD external causes coding seemed to be more contradictory in the primary health care. In addition, nurses reported that using breathalysers with every injury patient was unpleasant.

The wider context was associated with the project implementation. Support from the municipality's management team, national organisations and external funding are all most likely to be prerequisites for the successful initiation of a first large scale local injury registration project in Finland. On the contrary, hazy linkages between the project leader and the software specialists in the region and between the chains of software companies will complicate and slow down the process in several ways.

9 Existing national data sources

The first study approach (Ch 7) shows that local practitioners do not have the information available for injury prevention that they wish for. They have a vague knowledge of data sources. From the local practitioner's point of view the fragmentation of information into multitudinous information systems forms an obstacle to find and access data. Local information needs are, however, reasonable: Data and information to estimate the magnitude of the local injury problem, to understand the risk factors and local circumstances where accidents and injuries occur, to know more about safety behaviour and safety knowledge of the population in general and of specific population groups like youth, and to detect changes in the injury situation. The information is needed to convince decision makers that it is worth investing in injury prevention, to plan, set targets, and evaluate the injury prevention activities, to fulfill Safe Community recommendations, to improve the quality of services, to get personal feed back of ones own work and to conduct statutory safety promotion accident and injury prevention activities. However, information from surveillance systems is hardly used in local injury prevention and safety promotion activities.

Since progress in injury prevention and injury monitoring can be fostered by developing the contents and approaches to access and use the existing data sources (Florence et al. 2011; Horan et al. 2003; Quigg et al. 2011), the third study approach investigates the existing data sources in Finland. The aim is to investigate the potential that these data sources have in local injury surveillance and monitoring. As the first step a thorough understanding of sustainable data collections that include injury information is needed. Honkanen (1983) reviewed the Finnish injury data sources thirty years ago. After that no extensive analysis has been published.

The aim of the third substudy is to review in depth characteristics of the national data sources and assess their potential for improving injury surveillance and monitoring at the local level. The study aims to find answers to the following questions: (1) what are the ongoing data collection systems in Finland that contain injury information, (2) what is known of the data quality? (3) in what ways do data collection systems' characteristics affect local level monitoring?, (4) do data sharing and data delivery formats exist to target local audiences?

Firstly an analytical description of the relevant data sources is presented. The description is based on data from scientific articles, grey literature, interviews and other forms of data including personal communications with experts. The following criteria were used in selecting research material: for scientific articles searches were conducted using the PubMed and SafetyLit databases and after that a snowball technique was used to find additional documents. Of the so-called grey literature, only written material published in the data owner's statistical reports or internet pages

were used. All interviewed experts were highly competent informants with several years of experience with the data.

9.1 Evaluation framework

National data sources are defined here as ongoing information systems which collect and store data on accidents and injuries in national organisations. Local data collected by local organisations for local use only and trauma registers in EDs that do not collect data to be fed into national information systems were excluded. Furthermore, data collections on marine, rail road and aviation accidents were excluded from this substudy.

A total of 41 data sources that collect data on injuries in Finland were identified. A summary table of these is presented in the appendix 1. It provides information on each data source: data contents, data collection methods and the main purpose as described by the data administrator. The footnotes provide the sources of information for each data source. The appendix table provides an overview of *all* identified data sources. Only the data sources that provide local level data for local injury prevention have been examined in detail. For practical purposes the data sources were grouped into five groups before analysing them. The five groups are: (1) nation wide administrative registers, (2) emerging information systems, (3) accident investigation databases, (4) data sources on monitoring safety promotion practices, and (5) population surveys.

The evaluation framework for injury surveillance systems (EFISS) used for analyses is presented in chapter 3.7, and in detail by Mitchell et al (2008; 2009). The EFISS provides an outline to assess data quality and operational and practical characteristics in detail. During the data collection for this substudy it became evident that information required by the EFISS for each identified information system was not easily available. In addition the number of identified injury surveillance systems was extensive. Thus it was not possible to select all the characteristics included in the EFISS.

The selection was based on the relevance of each characteristic to the aim of the present study. The characteristics of the main purpose and objectives of each information system as well as case definition of injuries, data contents and the system used to classify injury related data were considered as the most important, since these characteristics define injury data collection in each information system. Secondly characteristics related directly to data and data quality, what is known of data completeness, sensitivity and specificity of the information system in relation to injury information and representativeness of the data were included. Without a good understanding of these characteristics it would not be possible to make any conclusions as to the value of each information system for prevention at the local level. Data collection process is important in order to understand if the process is optimal from the local prevention point of view. The data collection processes vary among

information systems. When and by whom the data and information can be accessed and is available for local prevention is important. Timeliness was included in the present analysis, since timeliness of injury information is commonly criticised. Data accessibility and guidance material to aid data interpretation were selected for the value these characteristics have for information utilisation.

In spite of their importance some of the characteristics in the EFISS were excluded. Positive predictive values were not found to be available and the assessment would have required actual data from at least two information systems, which was beyond the scope of this study. Confidentiality and privacy issues are of central importance and affect data utilisation. However, organisational practices to safe guard individual's information are not modifiable by the data administrator alone but to large extent regulated by national laws as well. Thus confidentiality and privacy of an information system cannot be analysed independently and data protection legislation analysis was again beyond the scope of this study. System security e.g. use of passwords, was considered as not relevant for this study being more relevant for the data administrator than for data user. Data quality control measures are associated with data completeness. Data completeness, rather than organisational practices to improve data completeness, was selected for investigation in this study.

The aim of this study is to investigate the opportunities that existing data sources have to enhance injury monitoring to support prevention at the local level. Therefore the level of analysis is not as detailed as the evaluation framework would allow. Instead of using the four-level rating scheme proposed by Mitchell and colleagues (2009) (from 1 'very high' to 4 'very low') for each criteria, a description of characteristics is presented.

9.2 Nationwide administrative registers

A total of 12 nationwide administrative registers (Table 4) were selected for a detailed analysis. The Finnish Register on Visual Impairment was excluded from the detailed analysis since the number of cases with a reason for impairment due to an injury is very low, approximately 10 new cases annually. This information system is thus not relevant for injury monitoring at the local level. Care register, social welfare institutional care and housing services was also excluded, since no indication that data from this information system would have been used to monitor injuries appeared during the research data collection for this substudy. The 12 selected registers for detailed analysis are not data sources based on samples, but rather total registers that collect data from throughout the entire country. All contain information that allows the breakdown of data by municipality. In spite of its official name Cause of death statistics database is a register with personal data and personal identification numbers.

Table 4: Nationwide administrative registers for injury monitoring

Name	Data administrator/data owner
Health based registers	
1. Causes of death statistics	Statistics Finland
2. Care register, inpatient hospital care	THL
Registers of police and rescue service authorities	
3. The information system of police affairs (PATJA), death investigations	National Police Board
4. The information system of police affairs (PATJA), road traffic accident investigations	National Police Board
5. The rescue services resource and accident statistics (PRONTO)	22 rescue regions
Specific traffic accident registers	
6. Statistics on road traffic accidents	Statistics Finland
7. Road traffic accidents on highways –statistics	Finnish transport agency
8. Insurance company data base on traffic accidents	The Finnish Motor Insures' Centre (FMIC)
Specific occupational accident registers	
9. Statistics on work accidents and occupational diseases	Federation of Accident Insurance Institutions (FAII)
10. Occupational accidents of farmers and people with grants and scholarships	Farmers' Social Insurance Institution (MELA)
11. Occupational accident statistics	Statistics Finland
Other registers	
12. Sickness allowances	KELA, The Social Insurance Institution of Finland

9.2.1 Main features

Of the 12 data sources two, the Causes of death statistics and the Care register collect data on all injury types. These data sources contain incidence information on all deaths and all inpatient treatment periods in the Finnish hospitals. The Causes of death statistics are available from 1936 (OSF 2011a) and the Care Register (previously hospital discharge register) since the end of the 1960s – for the latter adequate diagnosis codes have been available for statistics from the early 1970s. Annually there are around 3 000 fatal injuries and 100 000 inpatient discharges in Finland.

The information system, PATJA, of the National Police Board contains data on death investigations and traffic accidents. Annually the police conduct over 10 000 death investigations and record over 20 000 traffic accidents. In 2008 the police visited 25 400 traffic accident sites and around 6 000 non-fatal injuries and 226 fatalities were reported (Niskanen 2011). Data collected by police is further used for other national information systems. The death investigations conducted by police are used for the Official Statistics of Finland (OSF) Causes of death statistics and the traffic accident investigation data for OSF on road traffic accidents (Tiippana 2010). The road traffic accident data from Statistics Finland are further used for the Road traffic accidents on highways –statistics by the Finnish transport agency. In 2008 around 3 500 accidents occurred on highways (Finnish Road Administration 2009).

The information system PRONTO of the rescue service authorities is based on rescue service operations. PRONTO contains information on fire-fighting tasks, but also on other rescue operations, such as traffic accidents. In 2009 around 10 000 non-fatal injuries and 623 fatal accidents were entered in PRONTO. The contents of the PRONTO and PATJA databases overlap when police and rescue service authorities visit the same accident sites. Rescue service authorities conduct detailed investigations on all fires leading to death or serious injury: these data are entered into PRONTO. (Kokki 2010.)

The official statistics on road traffic accidents are produced by Statistics Finland and have existed since 1931. They are based on accidents involving personal injury that are entered into PATJA and reported to Statistics Finland. (OSF 2009c) The road traffic accidents on highways –statistics are extracted from the OSF on road traffic accidents data. The data for road traffic accidents on highways is supplemented with other data, such as road and weather conditions data (Forsberg 2010.)

Data on motor vehicle crashes is also collected as a by-product of insurance activities. In 2008 the OSF on road traffic accidents included almost 6 900 road traffic accidents involving personal injury (OSF 2009c), whereas the database at Finnish Motor Insures Centre (FMIC) included 18 600 accidents with injuries (FMIC 2010b).

The OSF on occupational accidents is based on insurance data. The Farmers' social insurance institution (MELA) receives data from insurance institutions on occupational accidents of farmers and people with grants and scholarships (MELA 2010). All other occupational accident data from insurance institutions are delivered to the Federation of Accident Insurance Institutions (FAII). The information systems at MELA and FAII cover not only occupational accidents (work place and commute), but also accidents which have occurred during vocational training or, in schools, during handicraft, woodwork, and household or similar work type school hours. Both MELA and FAII transfer data on occupational accidents to Statistics Finland. (OSF 2011b) According to the OFS there were around 149 000 occupational accidents in 2007 (OSF 2012b).

The data compiled at Kela, the Social Insurance Institution of Finland, contains information on sickness allowances. Kela produces statistics on days for which sickness allowance is paid and the amount of the allowance in EURs (Pirttimäki 2010). In particular, the data from Kela is used by linking it to other health and injury surveillance data. In 2009 around 50 000 new sickness allowance spells began with an injury as the primary cause for which Kela paid compensation (KELA 2012b).

9.2.2 Purpose and objectives

According to Mitchell (2009) the purpose of an injury surveillance system refers to the reason why the system exists. If the purpose of data collection includes injury surveillance, it rates as very high. The legislation and other official documents re-

lated to each data collection were reviewed to find out if injury monitoring was mentioned as the purpose or objective of the data collection.

Causes of death statistics. The reason is defined in general terms by the statistics act (280/2004) that states: the task of the National Statistical Service is to produce, for general use, statistics describing social conditions and their development (1§). The objective of the statistical act is to ensure the availability of reliable statistical information required in social decision-making and planning (1§).

Care register, inpatient care. The responsible authority for the Care register is the National Institute for Health and Welfare (THL), which is one of the statutory statistical authorities for health and welfare in Finland. According to the act of THL (668/2008), the statutory functions of THL are e.g. to study and monitor the welfare and health of the population, the factors affecting and problems related to the welfare and health of the population, the prevalence of these problems and opportunities for preventing them (2§). Injury monitoring is not a statutory function of the THL. Anyhow, the purpose and objectives of the Care register is to provide data for health monitoring and for the use of health services. In practice Care register development take into account injury surveillance and monitoring needs.

Registers of the police and rescue service authorities (PATJA and PRONTO). The police act (493/1995) states that the police together with other authorities, local communities and people will act to maintain safety (1§). For that purpose the police shall have an information system (PATJA) into which personal data can be stored. However, data collection on accidents and injuries for prevention is not specifically mentioned. The police administration act (110/1992) defines the duties of the local police, which include improving traffic safety (7§).

The purpose of PRONTO is defined as a system for the follow-up and development of rescue services and accident monitoring (Kokki 2007). The rescue services act (379/2011) states that it is the duty of the rescue service authorities to monitor accident risks, accidents, and their causes and take actions to improve safety (1§, 91§). The primary purpose of PRONTO is to monitor accidents, not injuries (Kokki 2010).

Specific traffic accident registers. The Statistics act (280/2004) allows Statistics Finland to collect data on accidents (15§). It states that notwithstanding the provisions on secrecy, and as necessary for the production of statistics, state authorities shall be obliged to provide Statistics Finland with such personal data in their possession that describe a person's participation in a traffic or other accident and their causes (15§). The road traffic accidents on highways –statistics are justified by the Finnish transport agency as being for accident and injury prevention (Forsberg 2010). The use of the insurance company's data at FMIC for traffic safety promotion is mandated by a more general Motor liability insurance act (279/1959, (18a§).

Specific Occupational accident registers. The purpose for data collections in occupational accident registers is injury prevention and promotion of occupational safety. The Employment Accident Insurance Act (608/1948) mandates the statisti-

cal activities, the occupational accident investigations and efforts to promote occupational safety and accident prevention. For this purpose the FAII keeps a register for promoting safety at work and prevention of accidents and injuries at work (64§). MELA collects data and produces statistics on occupational injuries to farmers' and recipients' of grants for prevention. This activity is their statutory activity mandated by the Farmers' Accident Insurance Act (1026/1981, 22§). The OSF data collection is again mandated by the statistics act. However, the main role of Statistics Finland on occupational accidents is the international co-operation in this field, especially within European Union.

Sickness allowances. The purpose of data collection at Kela is to provide statistics on beneficiaries and benefit expenditures (KELA 2012b). The purpose of data collection does not include injury prevention.

Conclusion: The purpose and objectives of the administrative registers is classified into three categories: (1) statutory information systems for injury monitoring and prevention (registers at FMIC, FAII, MELA and PRONTO) (2) the basis of data collection general or the organisation's designated basic task (Causes of death, Care register, OFS on traffic and occupational injuries, PATJA and accidents on highways) and (3) the purpose of data collection does not include injury monitoring for prevention (sickness allowances).

9.2.3 Case definition

Administrative registers are rarely solely injury surveillance systems. Thus in addition to inclusion criterion for the register, injury cases are defined by the variables and classifications used in the data. According to the EFISS if variables in the data collection can identify the injury cases of interest it rates as very high.

The Causes of death statistics cover all persons who have died in Finland or abroad during the calendar year and who at the time of death were domiciled in Finland. The statistics are based on data in death certificates. Statistics Finland uses a underlying cause of death -variable to identify injuries. It is "the disease which has initiated the series of illnesses leading directly to death, or the circumstances connected with an accident or an act of violence which caused the injury or poisoning leading to death" and is determined according to the rules of the ICD-10 classification. Other variables to identify injuries are: other contributing causes of death and, since 1998, a variable to classify the cause of death into disease, occupational disease, injury, medical treatment, suicide, homicide, war or unknown. (OSF 2012a.)

The Care register, inpatient care. This register covers inpatient care and day surgery in public and private hospitals and health centres. The data are based on discharges annually and inpatients on 31st of December. Data included are those on episodes of care that end with a discharge, transfer to another hospital or medical specialty within the same hospital or death of the patient. The Care register has the following variables based on which injury cases can be defined: principal diagnosis,

side diagnoses, external cause and type of injury. In addition, the reason for entering the care –variable (28 categories) has a code for injury. (THL 2011.)

Registers of the police and rescue service authorities (PATJA and PRONTO). By law (1973/459) the police have to investigate deaths when they occur elsewhere than in a hospital. These death investigations form the death investigation database at PATJA. For accidents, the criterion for entry in the PATJA and PRONTO registers is that the police or a rescue service employee has been present at an accident site and entered data about the accident and injuries into the database. The variables that identify injuries in PATJA are: fatalities (yes, no) and injured persons (yes, no). Fatalities in road traffic or fire-related accidents in PATJA and PRONTO are defined as a death within 30 days of the accident. The number of fatalities, seriously injured, and slightly injured person in an accident are recorded into PRONTO. This information could be used to extract injury data. From 1996 till the end of 2011 a second variable 'injured persons or persons in immediate danger (yes/no)' was also used. All fire-related accidents with fatal or serious injuries are investigated and the information is entered into the PRONTO database. The investigation data allows an easy identification of these injuries (Kokki 2012).

Specific traffic accident registers. The criterion for entry in the registers of OSF on road traffic accidents and traffic accidents on highways are the same as in PATJA, since PATJA is the data source for these databases.

The entry criterion for the insurance based road traffic accident statistics at FMIC are (1) the car insurance holder has sent the accident statement to the insurance company and (2) a compensation claim of bodily harm has been sent to the insurance company and the company has paid the compensation (FMIC 2010a). The accident statement form includes a variable for injuries (even if slight) classified by no or yes. The database on compensations paid on bodily injuries forms the database.

Specific occupational accident registers. The entry criterion for the insurance based system is that the insurance company has paid a compensation on an occupational injury (Sysi-Aho 2010). The occupational accident registers are injury surveillance systems.

Sickness allowances. Injury cases cannot be defined in a reliable way from Kela's information systems (Pirttimäki 2010). Kela uses the ICD classification (10th revision). Diagnoses are coded at a three digit level, but external causes of injuries are not included in this data. As an example, sickness allowances may be paid due to back pain or visual impairment - but whether the cause is an injury is not known.

Conclusion: Injury cases can be identified from all the registers except from the register on the sickness allowances. However, the reliability of data on which the identification is based varies. Causes of death and Care register data are based on medical examination, PATJA and PRONTO on eye witness information (i.e. being present at the accident site) and insurance based registers on compensation claims. The data compilation method has implications on the sensitivity and specificity of the data source.

9.2.4 Data contents

The rating criteria in the EFISS is based on the number of variables in the surveillance system which are included in the recommended variables of the WHO's core minimum and optional data sets (MDS). The variables recommended in the WHO's core MDS are: an identifier that uniquely identifies each case to avoid double counting, age and sex of the injured, place where the injury occurred, activity while injured (e.g. swimming, driving), nature of injury (e.g. fracture, concussion) and mechanism of injury (e.g. traffic injury, drowning) (Holder et al. 2001, p 25). In addition, the WHO recommends optional data sets: race or ethnicity, external cause of injury, date of injury, time of injury, residence of injured person, whether alcohol or another substance was a factor, severity of an injury and disposition of an injured person (e.g. was the injured person treated in the emergency clinic of a hospital, discharged, or admitted to a hospital) (Holder et al. 2001, p 25). The guidelines furthermore suggest supplementary data sets for surveillance systems that are built for specific purposes like collecting injury data on assaults, traffic injuries or suicides (Holder et al. 2001, p. 26).

In the tables below the administrative registers are evaluated according to whether the data include the variables of core and optional data sets as recommended by the WHO (Holder et al. 2001; Mitchell et al. 2011). In the EFISS the injury surveillance systems rate as very high if the data collection contains 76 to 100% and high if the data collection contains 51 to 75% of the MDS variables. For the purposes of this study, two additional data elements were added into the evaluation: geographical location of the occurrence and narrative. When calculating the percentage, narrative was not included and data and time of injury were counted as two independent variables. The percentage result of the evaluation can only be considered as an indicative estimate of the usefulness of the register. The classifications used for specific injury variables affect the level of detail of information and thus its usefulness as well.

Causes of death statistics. The Causes of death data contain 68% of the variables listed as a reference in this study.

Table 5: Data recommended by the WHO in the Causes of death data

Variable	Yes	Comments
Identifier		
Demographics		
Age	X	
Sex	X	
Nationality	X	
Residence of injured person	X	
Circumstances of the incident		
Intent	X	
Place of occurrence (e.g. school, nursing home)	X	
Geographical information on accident (municipal, street, GPS)		
Activity	X	Traffic, work, sports, leisure activities, at home, in a care facility, other
Mechanism of injury	X	
External cause of injury	X	
Date and time of injury	X	
Alcohol as a factor	X	
Other drug as a factor	X	
Causal factors (e.g. Weather, speed, hazardous features)		This information sometimes found in the Narrative
Preventive factors (e.g. helmet use, use of hip protectors)		This information sometimes found in the Narrative
Mode of transport (e.g. pedestrian, car)	X	
Type of road user (e.g. driver, passenger)		This information sometimes found in the Narrative
Narrative		
Injury outcome		
Nature of injury	X	
Injury severity	X	

Care register, inpatient care. The inpatient discharges in the Care register contain 40% of the variables listed as a reference in this study. As is already known the medical care based registers contain little information on accident circumstances.

Table 6: Data recommended by the WHO in the Care register, inpatient care data

Variable	Yes	Comments
Identifier		
Demographics		
Age	X	
Sex	X	
Nationality		
Residence of injured person	X	
Circumstances of the incident		
Intent	X	
Place of occurrence (e.g. school, nursing home)	X	Traffic, work, sports, leisure activities, at home, in a care facility, other
Geographical information on accident (municipal, street, GPS)		
Activity		
Mechanism of injury	X	
External cause of injury	X	
Date and time of injury		
Alcohol as a factor		
Other drug as a factor		
Causal factors (e.g. Weather, speed, hazardous features)		
Preventive factors (e.g. helmet use, use of hip protectors)		
Mode of transport (e.g. pedestrian, car)	X	
Type of road user (e.g. driver, passenger)		
Narrative		
Injury outcome		
Nature of injury	X	
Injury severity		

Registers of the police and rescue service authorities (PATJA and PRONTO). The PATJA database contains only limited information on death investigations. The investigation reports are sent to the coroner for further use. The variables in PATJA related to traffic accidents contain 63% of the variables listed as a reference in this study.

The PRONTO database contains narrative information instead of classified data related to the accident. PRONTO contains 55% of the variables listed as a reference in this study for severe fire-related injuries. The data contents are more detailed on Fire accident investigations.

Table 7: Data recommended by the WHO in the PATJA and PRONTO databases.

Variable	PATJA, Death Yes	PATJA, Road Yes	PRONTO Yes	Comments
Identifier	X	X	X	
Demographics				
Age		X	X	PRONTO: information available on Fire related accident investigations only.
Sex	X	X	X	PRONTO: information available on Fire related accident investigations only.
Nationality	X			PATJA: Country of birth and nationality
Residence of injured person	X	X	X	PRONTO: information available on Fire related accident investigations only.
Circumstances of the incident				
Intent	X			Suspected suicide, victim of violent crime
Place of occurrence (e.g. school, nursing home)		X	X	PRONTO: on house fires
Geographical information on accident (municipal, street, GPS)		X	X	
Activity				
Mechanism of injury		X	X	
External cause of injury				
Date and time of injury	X	X	X	
Alcohol as a factor		X	X	PRONTO: information available on Fire related accident investigations only.
Other drug as a factor		X		
Causal factors (e.g.weather, speed, hazardous features)		X	X	PRONTO: information available on Fire related accident investigations only, in car crashes: was a weather warning given PATJA: weather, lighting, road-surface conditions etc.
Preventive factors (e.g.helmet use, use of hip protectors)				
Mode of transport (e.g. pedestrian, car)		X	X	
Type of road user (e.g. driver, passenger)		X		
Narrative		X	X	
Injury outcome				
Nature of injury				
Injury severity		X	X	2 category classification in PATJA and 3 category classification in PRONTO

Specific traffic accident registers. The OFS traffic accident data and the accidents on highways statistics both use PATJA data, thus variables included are the same as in PATJA, but additional environmental information and information on circumstances has been added. The insurance based data at FMIC contain data on consequences: compensations paid due to injuries and periods of functional limitations of the injured person. These data are not included in the MDS. Specific traffic accident data sources contain 70% of the variables listed as a reference in this study.

Table 8: Data recommended by the WHO in the specific traffic accident registers data

Variable	***OSF Yes***	***Highways Yes***	***FMIC Yes***	***Comments***
Identifier	X	X	X	
Demographics				
Age	X	X	X	
Sex	X	X	X	
Nationality	X	X		
Residence of injured Person	X	X	X	
Circumstances of the incident				
Intent				
Place of occurrence (e.g. school, nursing home)				
Geographical location of accident (municipal, street, GPS)	X	X	X	
Activity			X	FMIC: classification at work, on way to or from work, during leisure time
Mechanism of injury	X	X	X	
External cause of injury	X	X	X	
Date and time of injury	X	X	X	
Alcohol as a factor	X	X	X	FMIC: The information on substance use is included if police has been at the accident site.
Other drug as a factor	X	X	X	FMIC: The information on substance use is included if police has been at the accident site.
Causal factors (e.g. weather, speed, hazardous features)	X	X	X	
Preventive factors (e.g. helmet or seat belt use)				
Mode of transport (e.g. pedestrian, car)	X	X	X	
Type of road user (e.g. driver, passenger)	X	X	X	
Narrative	X	X	X	
Injury outcome				
Nature of injury				
Injury severity			X	4 category classification in FMIC database

Specific occupational accident registers. The occupational accident data contain 86% of the variables listed as a reference in this study. In addition data on functional limitations, days in hospital care and absenteeism days from work due to the injury are included. Since all use the same ESAW classification and standardised form for occupational accidents, Table 9 below describes all three registers (FAII, MELA, OSF).

Table 9: Data in the occupational accident registers recommended by the WHO.

Variable	Yes	Comments
Identifier	X	
Demographics		
Age	X	
Sex	X	
Nationality	X	
Residence of injured person	X	
Circumstances of the incident		
Intent	X	
Place of Occurrence (e.g. school, nursing home)	X	
Geographical location of accident (municipal, street, GPS)	X	
Activity	X	
Mechanism of injury	X	Information given by the injured person or someone representing them.
External cause of injury	X	
Date and time of injury	X	
Alcohol as a factor		Based on observation or given by the injured person
Other drug as a factor		Based on observation or given by the injured person
Causal factors (e.g. weather, speed, hazardous features)	X	Based on information available in the narrative field (coded afterwards)
Preventive factors (e.g. helmet use)	X	May be described in the narrative field (not coded)
Mode of transport (e.g. pedestrian, car)	X	
Type of road user (e.g. driver, passenger)	X	
Narrative	X	
Injury outcome		
Nature of injury	X	
Injury severity	X	Calculated on the basis of days absence from work

Sickness allowances. The sickness allowances register contains 27% of the variables listed as a reference in this study. The sickness allowance data, as in other insurance based data sources, include data on expenses.

Table 10: Data recommended by the WHO in the sickness allowances data

Variable	Yes	Comments
Identifier		
Demographics		
Age	X	
Sex	X	
Nationality	X	
Residence of injured person	X	
Circumstances of the incident		
Intent		
Place of occurrence (e.g. school, nursing home)		
Geographical location of accident (municipal, street, GPS)		
Activity		
Mechanism of injury		
External cause of injury		
Date and time of injury		
Alcohol as a factor		
Other drug as a factor		
Causal factors (e.g. Weather, speed, hazardous features)		
Preventive factors (e.g. helmet use, use of hip protectors)		
Mode of transport (e.g. pedestrian, car)		
Type of road user (e.g. driver, passenger)		
Narrative		
Injury outcome		
Nature of injury	X	
Injury severity		

Conclusion: The EFISS uses the percentage of variables included in those variables recommended by the WHO for the core minimum and optional data sets as the rating criteria. According to the EFISS the occupational accident registers (FAII, MELA, OFS Occupational accident statistics) all rate as very high. The data collections include variables on demographics, broadly on all aspects of the circumstances of the injury and also on the outcome including information on functional limitations. The Causes of death statistics, all traffic accident data sources and PRONTO for the severe fire-related injuries all rate as high. The Care register/inpatient care rates as low and the sickness allowances data at Kela is rated as very low.

9.2.5 Classification systems

The rating criterion for a uniform classification system is whether standard classification systems are used to record information. If standard classification systems are used for most of the variables (76 – 100%) in the surveillance system, it rates as very high and very low if standard classification systems are not used or used for less than 25% of variables in the WHO's core minimum and optimal data sets. (Mitchell et al. 2009.)

Causes of death statistics. The Causes of death statistics use the ICD–10 classification (10th revision). The statistics use the most detailed level of the international version of the classification.

Care register, inpatient care. The Care register, inpatient care data uses the Finnish version of the ICD classification (10th revision). The external causes are coded on a three digit level. For the Finnish version of the ICD classification, new external cause codes have been added and in some cases the existing codes have been renamed in the Finnish version as compared to the international version. Thus some ICD codes may have a different meaning in the Finnish version from those in the international version. The changes to the Finnish version were justified as improving the monitoring of some typical injuries in Finland, such as carbon monoxide poisoning in saunas. In addition, a specific injury type classification is included in the Finnish ICD classification. The injury type classification is a substitute for the activity and place of occurrence codes in the international ICD 10 classification's 4th and 5th digits. The type of injury classification includes the following classes: unspecified type of accident, other type of accident, school or kindergarten related condition, work-related condition, accident in a hospital or hospital associated external cause, other leisure activity accident, accident in a restaurant, accident in traffic area, accident with sport, sheltered housing related condition, and accident at home (THL/Datawell CodeServer 2010).

Registers of the police and rescue service authorities (PATJA and PRONTO). The PATJA and PRONTO information systems emphasise data collection on accidents and accident circumstances instead of injuries. They do not use any standard injury classification system. (Kokki 2010; Tiippana 2010.) Causes of death are not classified by the police in the PATJA; only suspected suicides and cases of drowning are coded (Niskanen 2011).

Specific traffic accident registers. The traffic accident statistics do not use any standard classification system.

Specific occupational accident registers. The occupational accident statistics uses the European Statistics on Accidents at Work (ESAW) classification (FAII 2002). The ESAW classification corresponds with the ICD classification at the 1st digit level in coding injuries. The classification of occupation used for occupational accident statistics at FAII and in labour force statistics at statistics Finland do not correspond. This complicates occupational accident risk calculations for municipal employees (Hintikka 2007).

Sickness allowances. The ICD classification is used to classify the medical reason for sickness allowances. No external cause codes are used.

Conclusion: The Causes of death statistics, Care register and the sickness allowance register, all use standardised ICD-10 classification and the occupational registers use a classification that corresponds with the ICD injury classification. The national ICD classification that is used in the Care register is not as detailed as the international

one on activity and place of occurrence coding. PATJA, and other registers based on the data collected by the police and PRONTO do not use any standard classification.

9.2.6 Data completeness

Mitchell and colleagues (2009) define data completeness in injury surveillance data as the proportion of missing, not known, or "other specified" data recorded *for key injury variables*. Data completeness rates very high if there are no missing, not known, "other specified" or unspecified data on the key injury variables.

Causes of death statistics. Based on the available information there is no reason to suspect that the proportion of missing information of the causes of death information would be low for fatal injuries. Only 100 deaths out of 50 000 deaths annually are missing the causes of death information. Some of these 100 deaths are deaths abroad and some are deaths in Finland for which a death certificate was not acquired by the compilation time of the statistics. (OSF 2011a.) The causes of death are coded at the most accurate level and according to the international version of the ICD 10 classification (OSF 2011a). According to an expert (Hellanto 2010) at Statistics Finland the completeness rate for the external causes of death information on the three digit level is estimated to be high, but decreases for more detailed codes. The three digits contain the essential information. But missing information has its implications for injury monitoring. In the international version the digits after the 3rd digit contain information on the place of occurrence, for traffic injuries on the injured person's role (driver, passenger, person outside of the vehicle, unspecified) and for waterborne transport accidents the type of boat information.

Care register, inpatient hospital care. The completeness rate of inpatient data is lower than the Causes of death statistics data. Based on an expert opinion in practice the care register covers 100% of inpatient care periods and the principal diagnosis exists in practice in 100% of discharges (Pelanteri 2011). However, uninformative or missing data on the external cause and type of injury variables are frequent (Lunetta et al. 2008). Type of injury is a mandatory data field for discharges. In the years 2002–2004 the percentage of missing external cause codes in the register for inpatient care was less than 15% and varied according to age, duration of hospitalisation, nature of injury and type of hospital (Lunetta et al. 2008). The proportion of unspecified data recorded for the external cause variable has not been studied in detail in Finland. The proportion of inpatient discharges missing the type of injury information was around 20% in 2008 (Pelanteri 2011) but has decreased to 5% by 2010. In addition, the "other" or "unclassified" code was used in 15% of discharges. In practice this means that every fifth discharge does not have type of injury information. Further, since under reporting of both the external cause and the type of injury variables varies among hospital districts and hospitals (Lunetta et al. 2008), under reporting affects some regions and municipalities more than others.

Registers of the police and rescue service authorities (PATJA and PRONTO). No studies on data completeness were found for PATJA. According to an expert (Niskanen 2011) the completeness rate of PATJA is good for the variables used in the traffic accident data collection which are applicable for injury monitoring. The data completeness for key injury variables in PRONTO are expected to be good especially in fire-related and traffic accidents according to a study on the reliability of PRONTO data (Majuri et al. 2010). According to Valtonen (2011) geographical data of accidents have been recorded extensively into PRONTO, which is a benefit in comparison to other statistics.

Specific traffic accident registers. The number of variables where data is missing or coded as unspecified is expected to be low.

Specific occupational accident registers. The number of variables where data is missing or coded as unspecified is low (Sysi-Aho 2010)

Sickness allowances. The completeness rate is expected to be high for the diagnosis variables, since data is the basis for compensation payment.

Conclusion: The completeness rate is expected to be high in the Causes of death statistics. On the contrary the low completeness rate of external causes of injury affect especially the Care register's potential to provide information for injury monitoring. For some geographical areas the completeness rate of the Care register data is better than for others due to variations between hospitals in the coding practices. The proportion of missing or uninformative codes for key injury variables is most likely very low in the insurance based data. There are insufficient data to draw a reliable conclusion of the completeness rate for PATJA. PRONTO information system rates high in data completeness for fire-related accidents, and on the causes of these accidents. A recent study on PRONTO exist that identified areas for improvement (Majuri et al. 2010).

9.2.7 Sensitivity and specificity

According to Mitchell (2009) sensitivity refers to the ability to correctly detect all true injury cases and specificity to the ability to correctly detect all non-injury cases. The sensitivity of an injury surveillance system refers to its ability to correctly detect all injuries of interest and is often viewed in terms of "completeness of case ascertainment" (Mitchell 2008, 104). The specificity of a surveillance system is a measure of how many non-cases are misclassified as actual cases within the system (Mitchell 2008, 114). The sensitivity of each data source depends on its planned use. For example, some registers are more suitable for fire related injuries than others.. In this and the next subchapter only general features of the data sources will be discussed. More detailed assessments on sensitivity, specificity and representativeness for certain injury types could be made by comparing data sources. There are only a few published studies of this kind in Finland. These will be referred to in the following chapters.

Causes of death statistics. The sensitivity and specificity values of the Causes of death statistics are very high. The causes of death information is based on medical death certification in Finland and the accuracy of death certification relies heavily on post-mortem investigations (Lahti 2005). Finland has an act (459/1973) and decree on establishing causes of death and an exceedingly high medicolegal autopsy rates in comparison to other countries (Lunetta et al. 2007). Medicolegal autopsies cover approximately 90% of injury deaths and up to 10–15% of deaths due to diseases and medical conditions in Finland. This reduces the risk of misdiagnosis of deaths due to injury or intoxication as deaths due to diseases and medical conditions (Lunetta et al. 2007; Penttilä et al. 1999).

Medicolegal autopsies are performed in 87% of all unintentional injury deaths, 98% of homicides and 99% of suicides. The percentage of medicolegal autopsies has been constantly over 97% in all age groups under 64 years old, but among elderly people the medicolegal autopsy rates are lower, decreasing to under 60% for those over 80 years old. The relatively low medicolegal autopsy rates among the elderly are believed to reflect the high number of fall-related deaths, which occur especially in primary health care hospitals after prolonged hospitalisation and for which clinical data are generally known to the doctors. (Lunetta et al. 2007.)

Care register, inpatient care. The administrative registers are rarely injury surveillance systems, but the data sets extracted from the registers form the data for injury surveillance. In practice the Care register covers 100% of inpatient discharges. Firstly, sensitivity and specificity are dependent on the accuracy of the variables used to define injuries and secondly on the computational practices to calculate injury incidences from the database on care episodes. Thus sensitivity and specificity are also dependent on the competence of the statistician who defines and extracts the injury data from the register (Gedeborg et al. 2008; Sund 2008, 22-23).

The principal and the secondary diagnoses, the external causes of injury and the type of injury variables are used to extract injury data from the Care register. In Finland the diagnosis codes are given by medical doctors. In practice they enter these data into the electronic patient journal themselves or they dictate the information that later will be entered into the electronic files by department assistants. There are no recent studies on the data accuracy of the Care Register. Study results published 20 years ago reported a 96% consistency of the principal diagnosis codes for injuries and poisonings when compared with data in the patient journals (Aro et al. 1990; Keskimäki et al. 1991). Since that time automated quality controls both in hospitals and by the register keeper have been developed. Experts (Gissler et al. 2004; Mattila 2005) argue that the accuracy of the Care register for injury and poisoning diagnosis codes is still high. Further, more recent studies show that the accuracy is high: there is 92–98% agreement between the specific injury diagnosis and the Care register. Assessments of the correctness of coding exists for hip fractures (Sund et al. 2007) and for cruciate ligament (Mattila et al. 2008). Data completeness for the external

codes is low as was described earlier and no recent accuracy studies on external causes and type of injury are available.

Even for more sophisticated injury statistics the incidence rates are always based, to some extent, on assumptions of which care episodes are associated with the same injury occurrence. For annual statistics on patients, discharges or bed days a standard procedure is used. These statistics do not give as accurate figure of the injury incidences as epidemiological studies with careful computational data practices would give. For more exact injury incidence statistics the care periods of the same injury need to be combined.

Registers of the police and rescue service authorities (PATJA and PRONTO). The sensitivity of PATJA and PRONTO are affected by the fact that the data includes cases of accidents based on site visits on request. No accurate estimate of underreporting (reports not done after an accident site visited) is available. An expert estimate is that it is most likely that all accidents at least with a severe personal injury are reported (Tiippana 2010). The extraction of data on accidents with injuries is based on the Injury –variables. Since data entered into PATJA and PRONTO are based on eyewitness information, the non-injury cases (illness) cannot be detected in a reliable way at the accident site. This reduces the specificity of both data sources.

Specific traffic accident registers. Registers based on PATJA share the same features as PATJA itself. The road traffic accident statistics at the FMIC cover accidents compensated by the insurance companies (FMIC 2010a). In practice 100% of compensated accidents are included.

Specific occupational accident registers. The sensitivity and specificity of the occupational accident register to detect injuries at work is assumed to be high. When someone is treated in a hospital or an ED for an occupational injury, the care giver sends a request for reimbursement to an insurance company. For this reason the occupational injury surveillance system is able to catch even less severe injuries.(Sysi-Aho 2010.) However, there are personnel variations on when to seek medical help for an injury.

Sickness allowances. The limitation of the Kela database is its inability to identify injury cases, since external cause data are excluded in the data. Thus both sensitivity and specificity for any injury monitoring are poor.

Conclusion: In practice the Causes of death statistics cover 100% of deaths and, due to the high medicolegal autopsy rate, injuries can reliably be separated from other causes of death. Further, since the completeness rate of the external cause information is high, the sensitivity and specificity in the Finnish Causes of death statistics are estimated to be good. In practice the Care register covers 100% of inpatient care periods. The specificity of the Care register is affected by the low completeness rate of the data. Monitoring of various types of injuries, that the classification (when used properly) should allow, is not possible. Calculating true estimates for injury incidences requires a thorough understanding of the data compilation process, the data contents and the ICD classification. The sensitivity of the Care register cannot

be assessed without taking the statistician's competencies and experience into consideration (Sund 2008, 19 - 32).

The sensitivity of PATJA and PRONTO depends on the planned use. PRONTO catches severe flame induced injuries well, but obviously misses those where rescue employees have not been present. Injury detection at the accident site is based on eyewitness information, which affects the specificity. However, accident investigations of severe fire-related injuries decrease the possibility of misclassifying a non-injury as an injury.

Insurance based data sources cover in principle 100% of compensated accidents and injuries. In less severe injuries information is based on injured person's own notice, which affects sensitivity of the insurance based data. Sensitivity and specificity of Kela data collection is low for injury monitoring.

9.2.8 Representativeness

According to Mitchell and colleagues (2009) representativeness refers to the ability to provide an accurate representation of the distribution of key characteristics of the *injured* population. By key characteristics they mean demographic variables of sex and age and injury variables of intent, activity, place of occurrence, mechanism of injury and the injury outcome. To evaluate the representativeness of the injured population one has to be able to compare the characteristics of the injured population in data to a recognised 'gold standard' or at least to another data collection (Mitchell 2012). If the data source is to be used for policy monitoring, the policy makers at local level need to know how using information from a particular data source will influence the types of individuals and injury incidents as this will affect the understanding of the magnitude of the issue (Mitchell et al. 2011). It would be ideal to examine the representativeness of the distribution of the key injury surveillance variables. However, this is not always possible due to the use of different catchment criteria, completeness of data, variables and classification systems in administrative registers.

Causes of death statistics. The Causes of death statistics cover the entire country, so that absolute numbers and incidence rates are true population figures and not sample-based estimates. The causes of death statistics in practice cover 100% of deaths in Finland because the data on deaths are verified from the population information system (OSF 2011a).

Care register, inpatient care. A common view among experts is that the Care Register covers all inpatient treatment periods reliably nationwide (Gissler et al. 2004; Mattila 2005). How accurate a representation of injuries among Finns does the register give? Care Register/inpatient care data is based on admissions to hospitals, thus it covers all injuries (all age groups, sexes, all environments and situations) severe enough to be treated in a hospital. However, the Care Register does not provide a true population figure for injury morbidity. The level of injury severity and type of

injury affects the incidence rate of hospitalisation. Alcohol intoxications are seen in the causes of death statistics and in statistics based on ambulatory care, but not frequently in statistics based on inpatient care. Similarly sport injuries are more frequent in ambulatory care statistics than in inpatient statistics.

Since the Care Register contains information on the patient's municipality of residence, statistics based on this information can be produced. Contrastingly, since the information system does not have information on the geographical location (GPS coordinates or other variables) of an accident, the data source is not able to provide statistics on accidents by the municipality or region of occurrence.

Registers of the police and rescue service authorities (PATJA and PRONTO). Police investigations are performed, as a rule, when a death, also due to illness, occurs elsewhere than in a hospital (Niskanen 2011). In addition, deaths occurring in nursing homes with 24 hour personnel are not commonly investigated by police (Tiippana 2010). Thus the death investigation database of PATJA is incomplete for fatal injuries (Niskanen 2011; Tiippana 2010). Since the police are not always present at traffic accident sites, the PATJA database on road traffic accident investigations is not comprehensive either.

The representativeness of the rescue service authorities' information system PRONTO is not well known. Rescue service authorities visit fire accident sites, many traffic accident sites and some other accident sites. Majuri and Kokki (2010) compared PRONTO with the OSF causes of death statistics on fire-related deaths. The OSF causes of death statistics and PRONTO showed 108 and 107 fire-related deaths respectively in 2008, suggesting that fatal fire related injuries are well represented in PRONTO. They also compared PRONTO with the OSF traffic accident statistics. The number of non-fatal road traffic-related injuries recorded was 8 634 in PRONTO and 8 057 in OSF in 2009. Researchers gave no explanation for this difference. Possible explanations could be differences in data entering practices or that rescue service authorities visit more accident sites than the police.

Specific traffic accident registers. The official statistics on road traffic accidents (OSF) are based on PATJA data. It is commonly known that both data sources, PATJA and FMIC, are not representative in relation to injuries of mopedists, bicyclists and pedestrians. Thus data on unprotected road users are poorly available from data sources commonly used for road traffic accident monitoring. A Finnish study that compared the official statistics with ED based data in one municipality concluded that the official statistics cover a much smaller fraction of injuries than had previously been estimated (Airaksinen 2008). According to this study, the OFS on road traffic accidents covers less than 5% of bicyclists' and less than 35 % of mopedists' and motorcyclists' injuries when compared with ED data. In practice, the difference is even bigger. Airaksinen (2008) compared two-wheeler injuries in OSF traffic accident data to ED visits in specialised medical care, thus injuries treated in the primary health care were excluded from her study.

The FMIC database covers cases where compensation has been paid by an insurance company. Some traffic accident victims may not claim for compensation. This may occur to avoid the bonus ratings decreasing. Some may find it simpler just to treat themselves in a hospital without claiming compensation from an insurance company, since hospital care in public hospitals in Finland is almost free of charge. In cases involving drunken drivers insurance compensation is paid for the victim and these accidents are included. However, if a traffic accident occurs involving a drunken driver and no other parties exist no compensation is paid by an insurance institution. The FMIC data contains more accidents that the police data (FMIC 2010a).

The road accident in highways –statistics is based on data of the official road traffic accident statistics. It is expected that most motor vehicle accidents on highways are included in this data and the data is representative for its own targeted surveillance purposes (Forsberg 2010).

Specific occupational accident registers. The author does not know of any studies where the occupational accident registers have been compared with a "golden standard". Experts estimate that the information systems capture most occupational injuries and consequently represent well the population injured while working. Furthermore automatic computer-aided software is used at FAII to detect illogical coding. (Sysi-Aho 2010.)

However, some inaccuracies are known. Due to the European Commission's guidelines to avoid double registration of occupational injuries in Europe, occupational accidents to employees employed by foreign organisations in Finland as posted employees (as in the construction industry) are excluded from the data. Similarly Finnish employees' occupational accidents that occur abroad are in the data. Further, gray economy workers and uninsured private entrepreneurs are excluded from the data. The data may overestimate occupational injuries occurring while commuting to and from work. (Sysi-Aho 2010.)

Sickness allowances. The sickness allowance data source is not able to provide an accurate representation of injuries.

Conclusions: It is most likely that the Causes of death statistics can provide a representative distribution of key characteristics of the fatally injured population. The Care register can provide a fairly accurate representation of injuries that have led to inpatient care. The Care register has its limitations. A low completeness rate of the injury specific variables affects the data source. In addition, the Care register can provide regional and municipal statistics according to the patient's municipality of residence, not the place of injury occurrence. Furthermore, the Care register/inpatient care cannot provide a true representation of injury morbidity.

The representativeness of PATJA for fatal injuries is not known exactly. PRONTO covers most fire-related accidents. However, cases in the OSF Causes of death statistics will not be exactly the same as those in PATJA or PRONTO. There are fatal accidents abroad and both PATJA and PRONTO include fatal injuries if

they occur within 30 days of the accident, whereas for the OSF the follow-up period is longer.

There are known limitations related to pedestrians, cyclists, mopedists and motorcyclists injuries in all traffic injury data sources. The statistics underestimate the unprotected road users and are not able to provide a true representation of traffic accidents. These limitations disproportionally affect elderly and young road users who are not motor vehicle drivers but cyclists. The Occupational injury register is expected to give a good representation of the occupational injuries in Finland.

9.2.9 Data collection process

In the evaluation framework used for this study the rating for data collection process is based on the number of steps needed to collect the data. "If the data collection process takes one to three steps to complete, it rates as very high" (Mitchell et al. 2009).

Causes of death statistics. A death certificate issued by a physician is the data source for causes of death statistics. The causes of death information on death certificates are based on police investigation, forensic autopsy, medical autopsy or clinical examination. The investigation information collected by police will be sent to a coroner, who after their own investigation writes the cause of death certificate. The death certificate is delivered to THL, which is the national authority for forensic medicine, for checking. THL delivers death certificates to Statistics Finland where the causes of death statistics are formed. (OSF 2011a.)

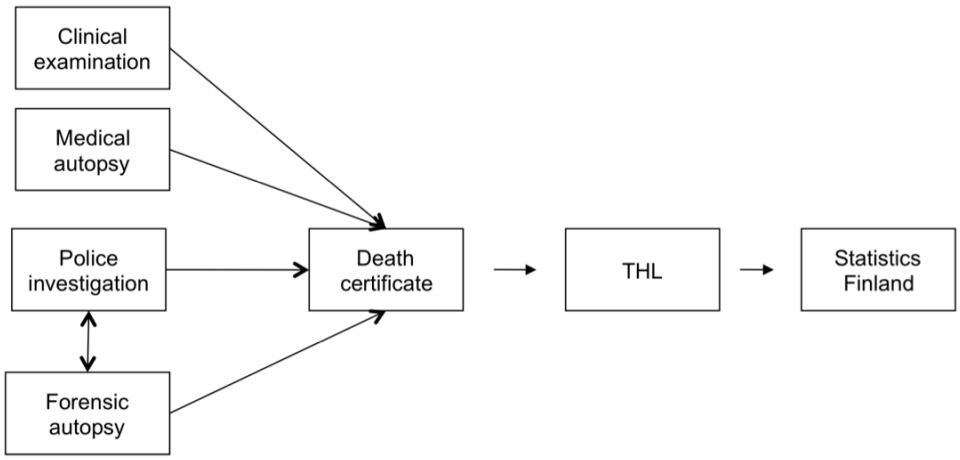

Figure 8: Data collection process for causes of death statistics

Care register, inpatient care. The data are based on information collected during the medical care. Key injury data are entered directly into the electronic patient

journals in the hospital by the physician or dictated by the physician and later entered in the electronic patient journal by a hospital secretary. Data extraction of inpatient discharges from the electronic patient journals in the hospitals are automatically done by specific computer programs and delivered to THL once a year. THL still receives a small proportion, less than 2%, of discharges in paper forms in which cases the data is entered into the Care register at THL (Pelanteri 2011). The steps for the Care register are: Entering data in the hospital (1 or 2 steps), data extraction from the electronic patient journal database, data sent to THL and database compiled at THL.

Registers of the police and rescue service authorities (PATJA and PRONTO). For death investigations the police will request data e.g. medical data (forensic autopsy, medical autopsy, clinical examination). For data based on accident site visits, only one step is involved in data collection in both PATJA and PRONTO. Data are entered into the database by the local police or rescue service personnel almost in real time. PATJA statistics can be viewed and shared by local police (Tiippana 2010). The 22 rescue service regions are register keepers of PRONTO, and rescue service employees at the local level can view PRONTO data and compile statistics for local use (Kokki 2010).

Specific traffic accident registers. The data source for the official Finnish traffic accident statistics provided by Statistics Finland is the police information system PATJA. The data the police have entered into PATJA are transferred to Statistics Finland (OSF 2009c). At Statistics Finland the data from the police are supplemented with data from the Road Administration and from the Causes of death database (OSF 2009c). Statistics Finland transfers data to Finnish Transport Agency without person identification numbers for injured persons. In the Finnish Transport Agency the accident data is linked and supplemented with road condition and traffic volume data (Forsberg 2010). The insurance based traffic accident data at FMIC needs the following three steps: filling the compensation form by the recipient, entering the insurance claim into the database at the insurance institution and transferring the data to FMIC (FMIC 2010a).

Specific occupational accident registers. The data for the occupational accident statistics are created as a by-product from insurance activity, so that all the occupational accidents for which insurance institutions have paid compensations are recorded. The first step in the process is a form filled by the victim or sometimes by the occupational health and safety representative. The injury form will be sent to an insurance company where the insurance claims handler verifies the correctness of the coding and the legitimacy for the compensation. In addition, the insurance company gets separate claims for the same injury from the EDs that have provided the medical care. The independent claims will be merged by a unique accident identification code. Next the data will be delivered from the insurance institutions into FAII. MELA as an insurance organisation receives forms on occupational accidents for farmers and those receiving their salary in the form of a scholarship. MELA and

FAII deliver data to Statistics Finland for the official occupational accident statistics (OSF 2011b). By merging these two different data sources Statistics Finland creates a database based on occupational accidents compensated by insurance institutions (OSF 2011b; Sysi-Aho 2010).

Conclusion: The number of steps needed to collect data for the Causes of death statistics is five, for the Care register/inpatient data four, for PATJA and PRONTO one, for Statistics on road traffic accidents at Statistics Finland three, for road traffic accidents on highways five, for the FMIC database three, and for occupational accidents four. An extra step is required to extract injury specific data from the Causes of death, the Care register, PATJA, PRONTO and the FMIC database. The EFISS rates the data collection process as high or very high if the process takes six or less steps. All Finnish administrative registers rate very high (one to three steps) or high (four to five steps) by the EFISS rating.

9.2.10 Timeliness

According to the EFISS the timeliness rates as high, if the time taken to complete data collection, data analysis, interpretation and dissemination is annual to biennial. A faster process rates as very high.

Causes of death statistics. For the Causes of death statistics the data for the preceding year will be ready in November the following year. This is the time for the first releases. (OSF 2011c.)

Care register, inpatient care. For the Care Register the timeliness is faster than for the Causes of death statistics. The time of release is between June and August the following year.

Registers of the police and rescue service authorities (PATJA and PRONTO). Both PATJA and PRONTO information systems' timeliness rates very high since both provide in practice real time statistics.

Specific traffic accident registers. The OFS statistics on road traffic accidents are published as preliminary data every month and the final annual statistics are released in June from the end of the statistical reference year (Statistics Finland 2012). The road traffic accidents on highways statistics are published eight months (Forsberg 2010) and the FMIC statistics 11 months (Parkkari 2012) from the end of the statistical reference year.

Specific occupational accident registers. The OFS statistics on occupational accidents are published 17 months from the end of the statistical reference year (Statistics Finland 2012) and a broader statistical publication half a year after that (OSF 2011b). The release schedule on occupational accident statistics is staggered at FAII. First release of the statistics is from three to four months from the end of the statistical reference year. (Sysi-Aho 2010.)

Sickness allowances. The statistics on sickness allowances are published by Kela in March after the reference year of the statistics (KELA 2012a).

Conclusion: According to the EFISS the timeliness of the data source rates as very high if "the time taken to complete data collection, data analysis, interpretation and dissemination is daily to monthly" and as high if it "is annual to biannual". The timeliness rating for PATJA, PRONTO and preliminary dissemination of OFS Statistics on road traffic accidents is very high. For the rest of the administrative registers the timeliness is high.

9.2.11 Data accessibility

In the EFISS rating there is a criterion based on whether data is accessible in unit record or on aggregate level and whether data is accessible via internet or CD-ROM. If data is accessible for data users in unit record and via internet or from CD-ROM, the accessibility rates as high or very high. Aggregate level accessibility rates as low.

Causes of death statistics. Statistics Finland produces the annual causes of death statistics that are compiled by the so-called statistical underlying causes of death. The information is available at national level and by all regional divisions based on municipalities. However, any data by municipality are subject to user license and available on request only. For municipal based statistics there is a fee. Strict data security rules apply and no data can be accessed at unit level without a permit. (OSF 2011c.)

Care register, inpatient care. The register keeper, the department for statistics at THL, publishes 20 injury indicators by municipality in an on-line SOTKAnet statistics and indicator bank (THL 2012c). The indicators published annually by municipality are: Hospital care for injuries and poisonings, patients per 10 000 inhabitants (total, for age groups 0–6, 7–14, 15–24, 25–64, 65–74 and 75 and older), per 1 000 inhabitants (total, for age groups 0–15, 16–24, 25–64 and 65 and older), periods of care arising from accidents at home or during leisure time/10 000 (total, for age groups 0–14, 15–24, 25–44, 45–64 and 65 and older, periods of care arising from accidental falls/10 000 inhabitants (total and for those aged 65 and older) and hip fractures in those aged 65 and over, as a percentage of the total population of same age. The data administrator has developed another data delivery system for municipalities in the internet (HILMO cubicle). This system does not contain any information on injury types or external causes of injury. Strict data security rules apply and no data can be accessed at unit level without a permit.

Registers of the police and rescue service authorities (PATJA and PRONTO). Local data in PATJA and PRONTO may be accessed by the local police or the local rescue service authorities. PATJA is also accessible by some law-enforcement authorities (Tiippana 2010). Access to the death investigation data is not limited technically to within the police but according to law investigation reports can only be viewed by those who need the information for their work.

National indicators in PRONTO can be accessed on-line. Since PRONTO has no data on injured persons, a permit to access data at accident level can be given to other interested stakeholders. When compared to other data sources the difference is that at the local level the local police and rescue service authorities have real time access to their data and they also commonly participate in injury prevention activity at the local level. Thus in principle these data are accessible for the local injury prevention activity.

Specific traffic accident registers. Statistics Finland does not publish statistics on road traffic accidents by municipality. The following indicators are published on-line for 21 regions: accidents, number of fatal injuries (total and in 5-year age groups), number of non-fatally injured persons (total and in 5-year age groups) and number of fatal and non-fatally injured persons by mode of transport (pedestrian, bicycle, moped, motorcycle, passenger car driver, as a passenger in a passenger car, other car, other mode of transport) (Statistics Finland 2009).

Municipality based statistics are produced by Liikenneturva (the Central Organisation for traffic safety in Finland). Liikenneturva and the Finnish Transport Agency have developed information systems to deliver local traffic accident and injury information for local stakeholders. Nowadays Liikenneturva produces statistics for municipalities on request. These statistics are further used and delivered by Liikenneturva's 12 regional offices for regional and local traffic safety planning and monitoring. Data at the Finnish Transport Agency is used for road safety planning at a local level. Local information from Accidents on highways -statistics are used by ELYs (regional Centres for Economic Development, Transport and the Environment) to support local traffic safety work. (Forsberg 2010.) The insurance based traffic accident data at FMIC are available by municipality on request and free of charge (Valkonen 2010).

Specific occupational accident registers. FAII statistics: Researchers, insurance companies and occupational safety inspectors may access the TAPATURMAPAKKI database kept by the register keeper, FAII. Data is anonymous in the TAPATURMAPAKKI database. Narratives of the occupational accidents are vetted in the Technical University of Tampere where researchers remove information that could lead to person identification. Statistics by the municipality (municipality as the place of occurrence) can be compiled from the TAPATURMAPAKKI database. Access to this database is given after an instruction session and on permit only. Municipality based statistics on occupational accidents are available on request. (FAII 2012.) Statistics Finland does not publish occupational accident statistics by municipality. The municipality based statistics are available from Statistics Finland on request and for a fee if work required to with the request exceeds one hour. (Miettinen 2012.)

Sickness allowances. Statistics on sickness allowances by diagnosis are published among other statistical tables in the annual statistics book. Strict data security rules apply.

Conclusion: In spite of existing data in national registers and statistical databases, local practitioners do not have easy access to these data. Data is not made available for local data users. A summary of the results is presented in the table below.

Table 11: Accessibility of local information by administrative register

Administrative register	Data accessibility (by municipality)
Causes of death statistics	On request, fee
Care register, inpatient care	On request, few indicators available and accessible via internet
PATJA	Local employees may access traffic accident data in database in unit record
PRONTO	Local employees may access data in database in unit record, unit record data accessible by permit
OSF/Traffic accident data	For Statistics Finland: on request, fee. Instead of Statistics Finland, data sharing is done by Liikenneturva and Finnish Transport Agency
Traffic accident data at FMIC	On request, no fee
OSF/Occupational accident data	On request, fee
Occupational accident data at FAII	Unit level data accessible by permit via internet by an expert. For others data by municipality on request.
Sickness allowance data	Not available

The EFISS rates data accessibility as very high if "data is accessible for data users in unit record format from a data warehouse" and low if "data is accessible for data users in an aggregate format only" (Mitchell et al. 2009). On-line access to data in unit record format is available for the Police and rescue service organisations' own employees at the local level. In addition accessing occupational accident database in unit record is possible on permit. Since these unit level data can be used for prevention, these data sources are rated as high.

9.2.12 Guidance material to aid data interpretation

The existence of guidance material to aid interpretation of data is rated. If guidance material exists in the form of an up-to-date dictionary, manual or data user's guide and there is routine contact with data users related to data analyses this rates guidance material as very high. Without *routine contact* the information system rates still high. If guidance material exists but is not kept up-to-date, this rates as low and if there is no documentation or guidance material as very low. (Mitchell et al. 2009.)

Causes of death statistics. A license is always needed for producing municipal statistics from the Causes of death data. This means that a local practitioner requesting tailored statistics will automatically be in contact with the experts at Statistics Finland. Also up-to-date metadata to aid interpretation are available on Statistics

Finland's internet pages (OSF 2009a). Statistics Finland has no routine contacts with data users at local level on Causes of death statistics.

Care register, inpatient care. The SOTKAnet database contains 20 predefined injury indicators, all available by municipality and by region based on municipalities. Up-to-date guidance material for each indicator exists to aid interpretation (THL 2012c). The statistics department at THL has no routine contacts with local data users on injury statistics.

Registers of the police and rescue service authorities (PATJA and PRONTO). Data from PATJA and PRONTO are used and shared by the local police or rescue service authorities, who are familiar with the data and able to interpret the information. Information on PRONTO can also be found in the Emergency Services College's internet pages. The guidance material to interpret injury-related data in PATJA is intra-organisational. Data collected by the police is mostly published by Statistics Finland that publishes up-to-date guidance material on their internet pages.

Specific traffic accident registers. The official on-line statistics by Statistics Finland are available by regions based on municipalities and up-to-date guidance material to aid data interpretation is available (OSF 2009c). Statistics Finland has no routine contacts with road traffic accident data users in the municipalities. The contacts are via Liikenneturva's regional offices. Liikenneturva also delivers the municipal traffic accident information (Valtonen 2010). Guidance material to aid data interpretation is not available on-line from Liikenneturva. Road traffic accidents on highways -statistics by municipality are not available on-line for the general public. These statistics are delivered to regional and local data users in cooperation with the ELYs (Regional centres for Economic development, transport and the environment division). The ELYs have routine contact with and coordinate the traffic safety planning with local authorities. (Forsberg 2010.) Traffic accident data at FMIC are not actively disseminated into the municipalities, but upon request statistics by municipality are prepared free of charge (Valkonen 2010). Neither guidelines, a dictionary nor a manual for data interpretation is available on FMIC's internet pages.

Specific occupational accident registers. For insurance based information services the TAPATURMAPAKKI database has material for data interpretation. FAII is also the only register keeper that has a mandatory guidance session before it gives a permit to access the database. (Sysi-Aho 2010.) At a local level it is the occupational safety inspectors that may access the TAPATURMAPAKKI database. They are familiar with the data contents, since they are also data entrants. FAII has also published a user manual (FAII 2002). FAII publishes national level data on occupational accidents and injuries with guidance material to aid data interpretation. These are available on the organisation's internet pages. The OFS statistics on occupational accidents are not published by municipality or region. However, up-to-date guidance material to aid data interpretation is available (OSF 2011b). Statistics Finland has no routine contacts with occupational accident data users at local level.

Sickness allowances. No contacts with and no data delivered to injury prevention audience.

Conclusion: The police, rescue service authorities, Liikenneturva, Traffic Safety Agency and FAII have contacts with those working in municipalities or regions with injury prevention. Channels to communicate exist. Statistical authorities, Statistics Finland and THL, have guidance material on the internet to aid any data users in data interpretation. However, communication with local data users is not a common procedure. For the general public the intra-organisational material of the Police, rescue service authorities, Liikenneturva and Traffic Safety Agency are not available.

9.3 Emerging information systems

In this chapter those data sources are reviewed that are expected to have potential for local injury monitoring in the future. They are not yet sustainable and mature enough for injury surveillance. The following data collection systems will be discussed: Care register/outpatient care in EDs in the specialised medical care and in the primary health care, the FINJURY database and the health and well being survey for regions (ATH).

Table 12: Emerging information systems

Name	Responsible organisation (data owner)
1. Care register/ Outpatient visits in specialised medical care	THL
2. Care register/ Outpatient visits in primary health care	THL
3. FINJURY	THL
4. Health and well being survey (ATH)	THL

Care register/outpatient care. As pointed out (Ekman et al. 2008; Spinks et al. 2005) the outpatient data would, when available, provide useful data for local injury monitoring and programme evaluation. Data collection in ambulatory care has gradually been developed and its meaning in measuring health care outputs is constantly increasing. In Finland data collection on ambulatory care began first in the specialised medical care and data collection on outpatient visits in the primary health care has officially been part of the Care register from the beginning of 2011. Data is collected at an individual level with person identification numbers. The extension of Care register to include ambulatory care means that data from all ED visits throughout the entire nation will be available also for injury monitoring.

The outpatient data collection uses the same ICD 10 classification as the inpatient data collection for the Care register and the definition for injury cases is based on the principal and secondary diagnosis, external cause of injuries and type of injury. The primary health care is allowed to use the ICPC-2 classification that does not identify injury cases.

The representativity and completeness rate for outpatient data is unknown. Data collection is more comprehensive in the specialised medical care than in the primary

health care. Experts at THL's statistical unit estimate that approximately half of the specialised medical care hospitals delivering outpatient data into the national register also collect the external cause data in addition to the diagnosis data (Pelanteri 2011). In 2009 there were over 300 000 outpatient discharges in the Care register due to injuries within the specialised medical care. The completeness rate of the data from the primary care is unknown, but was very low in 2012.

FINJURY, the Finnish injury register, is currently a database for injury research at THL's injury prevention unit. The data sources from which injury data are extracted are: the Causes of death statistics and the Care register. In 2012 the database included injury mortality and morbidity data at an individual level from 1971 onwards. The data have been augmented with the cost data for hospital care. As the completeness rate and the quality of the outpatient care data in the Care register will improve, it is foreseen that this data will be actively used for injury surveillance using the FINJURY database.

FINJURY research includes the development of accurate injury indicators for variety of users. The first regional injury reports based on FINJURY data were published in 2008. These injury reports for injury monitoring at the local level have been developed in close collaboration with the regional rescue service authorities. Since 2008 the reports have been published annually and in 2011 for all 21 hospital districts in Finland as well. Each year rescue service authorities meet with the staff from the THL's injury prevention unit. These meetings are held to collect feedback, to discuss future data needs and to aid in data interpretation. Since the process to update the data in the FINJURY database occurs annually after the compilations of the registers used for FINJURY, the timeliness to publish the reports is 20 months from the end of the reference year. The reports include injury figures, tables and indicators by region and municipal on fatal and non-fatal, hospital treated, injuries.

Health and well being survey for regions (ATH). This survey is designed to collect population based data on the health and well being of pre-decided regions. The sample sizes are designed to allow representative figures for smaller regions with a population of 20 000 or more. A random sample from the Finnish population register of people 20 years or older is conducted. People 75 years or older have a twofold greater likelihood to be selected than those who are younger. Identification data includes geographical coordinate data of the person's home address. This allows data aggregations for a variety of geographical regions, including municipal subregions. Data is collected by postal questionnaires, but web-based answering is possible. The suggested injury questions include questions on injury occurrences, use of safety devices, use of health care services due to injuries and about falls and their consequences for elderly.

The whole processes of data collection and data sharing are automated to a large extent. The timeliness of data sharing is short and on-line guidance material is available for data users. The response rate has been between 50–60%, with higher rates among the elderly population. The rational of data collection is to collect cross sec-

tional data instead of monitoring data. Data collections and questionnaires are always negotiated with local stakeholders. (Kaikkonen 2010.)

Conclusion: National data collection on injuries treated in ambulatory care is nowadays part of the Care register, thus part of the national statistical system. Representativeness and completeness of data is not known, but in particular data from the primary health care organisations is expected to rate as very low. Dissemination of information on injuries and injury indicator development from the national health based data sources (the Causes of death statistics and Care register) have been part of a Finnish research project. In the future these data dissemination tools may be part of regular data dissemination practices. In addition to administrative registers, the ATH is an information system that has the capacity to provide injury information. The ATH survey can provide information on less severe injuries for local monitoring.

9.4 Accident investigation databases

Four organisations conduct accident investigations in Finland. The accident investigations are statutory activities of FMIC (24/2001, Act on the investigation on road traffic accidents), FAII and the Safety Investigation Authority. FMIC investigates fatal traffic accidents, FAII fatal accidents at work and the Safety Investigation Authority investigates all *major accidents* regardless of their nature, as well as all aviation, maritime and rail accidents and their incidents. These three investigations are conducted by investigation teams. TAPS is the fourth accident investigation system maintained by the occupational health and safety organisation in the ministry of Social Affairs and Health. TAPS database contains narrative descriptions of fatal or serious occupational accidents written by safety and health inspectors.

Table 13: Accident investigation databases in Finland in 2012.

Topic	Administrator
1. Road and cross county traffic accident investigations	FMIC
2. Fatal occupational accident investigations	FAII
3. TAPS investigation database	Ministry of Social Affairs and Health/The Regional Safety Administrative Agency of the Western and Inner Finland
4. Investigations of major accidents	Safety Investigation Authority

The investigation processes involve several stakeholders and by providing detailed information on factors leading to accidents, the investigations at best lead to measures to improve safety. Often investigations have a high local relevance, for example: Fire in Detached House Leading to the Dead of Five Young People (Safety Investigation Authority 2009) or Collapse of a Sports Hall Roof Investigation (Safety Investigation Authority 2010). The investigation data naturally provide in-

formation on circumstances leading to severe and fatal injuries instead of data for monitoring injuries.

Currently the investigations are limited to a relatively small fragment of all fatal or severe injuries. However, the legislation on major accident investigations was renewed in 2011. The new act on investigations to improve safety (525/2011) allows the Safety Investigation Authority to investigate accidents that are common causes for fatal injuries, but usually not major accidents. As an example an investigation on water-related deaths was conducted in 2011. To collect data for this investigation, police investigated all drowning accidents and other water-related accidents in one year in a detail. (Safety Investigation Authority 2011.)

The accident investigation databases' role for local injury monitoring is to provide detailed information on accidents on request. Reports and publications are available via internet. TAPS investigation reports can be accessed freely at unit level via internet.

Conclusion: Accident investigations are a statutory activity. They cover major accidents involving or threatening the lives of several people, fatal and severe occupational and traffic accidents. Investigations are accessible from databases (FMIC, TAPS, FAII) and from investigation reports (Safety Investigation Authority, FMIC).

9.5 Surveys on injury prevention activity and practices

Information systems on injury surveillance and monitoring collect data on injury incidences, their causes and consequences. Contextual and environmental factors associated with the accident occurrences are investigated in detail in accident investigations. Even though data collection on organisations' injury prevention and safety promotion practices is not a part of injury surveillance or a monitoring system, it is one data type needed to monitor changes in the injury prevention activity. There are few data collection instruments for these purposes in Finland. Three of them collect data on working conditions and work safety. These data sources do not contribute data for local injury surveillance and monitoring.

Table 14: Data sources on monitoring injury prevention practices

Topic	Administrator
1. Barometer of maintenance of workability	Finnish Institute of Occupational Health
2. Barometer of working conditions	Ministry of Employment and the Economy
3. Quality of work life survey	Statistics Finland
4. TedBM survey on health promotion practices within municipality	THL
5. TedBM survey on school health promotion	THL
6. TedBM survey on health promotion within primary health care	THL

TedBM data collections. The Health Promotion Bench Marking -project (TedBM project) in Finland (THL 2012a) has developed methods and questionnaires to moni-

tor health promotion activity in municipalities, schools and in the primary health care organisations. These data collections include questions on the implementation of national health promotion (including injury prevention) programmes, resources and commitment to and management of health promoting activity. TedBM data collections have begun in the 2000s, in the schools they began in 2007, in municipalities in 2007 and in health care centres in 2008 (Saaristo 2012).

The data collection method is an electronic questionnaire. The results are delivered via various channels including THL's internet pages. Data is analysed and reported within a year after the compilation of the data. A specific internet based tool to share data, visualise the results e.g. a possibility to compare the results of a municipality with region or national average has been developed. The Healthy Cities network has been actively involved with the development of the TedBM Information systems.

Conclusion: Investments have been made to develop information systems to monitor health promotion activity in municipalities, in primary health care and in educational institutions during the 2000s. Data collections include questions on the implementation of injury prevention programmes and on injury prevention activity. Currently the information systems include timeliness on-line data sharing. Information systems are developing, but not yet sustainable.

9.6 Population surveys

Thirteen repeatedly conducted population surveys that collect injury data exist in Finland. The only population survey that collects data at the municipal level is the School health promoting study. The rest of them collect data for national monitoring purposes, but could provide data collection models and reference data for local practitioners.

Table 15: Population surveys collecting injury data

Name	Administrator
1. School health promoting study	THL
2. National victimisation survey	The National research Institute of Legal Policy and THL
3. The European School Survey Project on Alcohol and Other Drugs (ESPAD)	THL
4. The Adolescent Health and Lifestyle Survey in Finland	University of Tampere
5. Health Behaviour in School-aged Children (HBSC) study	University of Jyväskylä and WHO
6. Health Behaviour among the Finnish adult population (AVTK)	THL
7. Traffic behaviour monitoring	Liikenneturva
8. Traffic Climate evaluation	Liikenneturva
9. The National FINRISKI study	THL
10. Health 2000 follow up study	THL
11. Work and health survey	Finnish Institute of Occupational Health
12. Health behaviour among the Finnish elderly (EVTK)	THL
13. Citizens' views and knowledge on rescue services	Ministry of Interior

Surveys collect data on injury incidences, on safety promotion practices, on peoples' opinions of safety and safety knowledge. They fulfill to some extent data gaps at the national level. Their value at a local level is to provide data collection models and reference data.

The school health promoting study is the only survey that collects injury data relevant for the local level. The questionnaire is filled by students in a class and sent to THL where a national data will be compiled. Data is collected biannually. About 90% of the Finnish municipalities join in the study. The age range of the respondents is from 14 to 20 years. Since data is collected from all the schools in municipalities providing education for the respondents' age group, the data represent adolescent population well. The sensitivity for injury monitoring is weakened by the fact that data is self reported. Only a few questions related to injuries are in the questionnaire, the main question being: have you been in an injury at school or while commuting to/from school during this school year. (Data is collected in spring). The results are delivered by municipality and school during the same year as they are collected. Dissemination of information includes reports and regional seminars where the results will be discussed with local authorities who have ordered and paid for the study. (THL 2012b.)

Conclusion: Survey instruments in Finland do not collect injury data in such a way that they would complement each other. The same or similar questions are asked in various surveys. In most surveys the information is limited to incidence information. Have you been injured during the past 6/12 months? The severity of injuries under investigation varies in the surveys from including all, even home treated to more severe where the threshold line is whether care from a medical doctor was needed.

9.7 Summary of results

This substudy assessed the existing data collections in Finland from which data for the local injury surveillance and monitoring could be obtained. Firstly an inventory of data sources was carried out. In the second stage data sources that fulfilled the inclusion criterion were analysed in detail.

A total of 41 data collections were identified that fulfill the inclusion criterion. These data sources were independently analysed. Out of the 41 data collections 22 (56%) included information to identify the municipality. The 22 data sources are summarised below (Table 15).

Table 16: National data sources for local injury monitoring by data collection method

	Nationwide registers	Accident investigation databases	Surveys
All injuries	1. Cause of death statistics 2. Care register, • inpatient care • outpatient visits in specialised medical care • outpatient visits in primary health care -> FINJURY	1. Investigations of major accidents	1.Health and well being survey (ATH) 2. School health survey 3. TedBM surveys on • health promotion policies within municipalities • school health promotion • health promotion within primary health care
Traffic accidents	3. Road traffic accident investigations of the Police (PATJA) -> OFS statistics on road traffic accidents -> Road traffic accidents on highways 4. Road and cross country traffic accident statistics (FMIC)	2. Road and cross country traffic accident investigations	
Occupational accidents	5. Statistics on work accidents at FAII and MELA -> OFS Occupational accident statistics	3. Fatal occupational accident investigations 4. TAPS investigations	
Fire related accidents	6. PRONTO, the rescue service accident statistics	6. Investigations of fatal or severe fire-related injuries are part of the PRONTO.	

Local practitioners often make requests for general level data. Trend information and incidence information at a general level could in principle be prepared from the national data sources for local use. Local practitioners also frequently request more detailed information on injury circumstances, risk factors and the place of occurrence in their own local community. Data on injury circumstances are only available for limited injury types from the national data sources. The morbidity data (Care register) have hardly any information on circumstances of the injury incident. The occupational and traffic accident data sources are more elaborate in this respect, and PRONTO includes data on the circumstances of the occurrence of open fire-related injuries. In addition to administrative databases, accident investigations are conducted on a regular basis for occupational, traffic and fire-related fatal and severe injuries. Since traffic, occupational and fire-related injuries form only 20–30% of all

fatal or inpatient treated injuries in Finland, the data on injury circumstances is not available for most injuries from the national data sources.

Population level data collections on risk factors do not collect information for the local level. The emerging ATH data collection may provide a limited amount of risk factor information for a selection of local communities in the future. In addition, the emerging TedBM data collection on health promotion activity could also provide essential information on injury prevention activity in the future for local communities.

Existing data sources in Finland are not yet able to provide a comprehensive picture of injuries. Data gaps would remain even if all the collected data were used. The Causes of death statistics and the Care register cover all injuries that require at least medical care. Since the Care register does not yet provide reliable information on injuries commonly treated in ambulatory care, such as sports injuries, injuries to pedestrians or unprotected road users or injuries in day care, these injuries remain outside the national data collection. Data on school injuries in the school health survey is based on information provided by the students themselves, which lowers the reliability of the data. In addition, the low completeness rate of external causes and the type of injury variables in the Care register lowers the value of this data for local prevention.

The administrative registers are not symmetrical with each other in terms of injury definition, the classifications in use and the variables included. This has an impact on the joint-use of the data sources, which would be an attractive alternative to improve the shortcomings of each individual data source.

Timeliness was rated as good or very good for all of the national administrative data sources. In addition, data collection processes seem to work reasonably smoothly for each individual data collection.

A precise injury case identification is a prerequisite for the use of a data source for injury monitoring. The assessment of existing national data sources recognises weaknesses and difficulties in this respect. The injury case identification is expected to be most precise from the Causes of death statistics. When case identification is based on eye-witness information (PATJA, PRONTO) or on a person's own information (FAII, MELA, ATH, School health survey) it is expected to be less precise. In addition, in these data sources the injury outcome is not classified, except in the FAII and MELA data collections. The FAII and MELA databases include more detailed data on injuries than the others. Methodological challenges to identifying injuries from the Care register, in which the statistical unit is a care period instead of an injury, exist. Extracting high quality injury data from this database requires a good level of data completeness and expertise on the classifications and the statistical processing of the data.

The assessment of the national data sources also raised concerns about data quality. Data quality on injury specific variables is to a large extent unknown. Only a few recent studies exist. Currently there is insufficient data to draw accurate con-

clusions about injury data quality. The completeness rate, representativeness, sensitivity and specificity in the Causes of death and occupational accident statistics are most likely to be high in Finland. These data could give a reliable estimate of fatal or occupational injuries in a municipality. Even though the data quality of the Care register on injury specific variables has improved in Finland, problems related to the low completeness rate of the injury specific variables (external cases of injury and type of injury) still affect the usability of the data. Data on traffic accidents have widely recognised limitations related to representativeness.

Local information seems to stay to a large extent in the data collecting organisations. Despite the multitudinous data collected on injuries, local data is not commonly published by the municipalities. Instead it has to be requested. In addition to data on injuries, local practitioners also require models to collect additional data and data on risk factors and the economic burden of injuries. Several Finnish surveys collect risk factor data, but the methodology descriptions and questions are not easily found and are located in several places. The cost information that is already collected is not disseminated for local injury prevention activity.

National data sources for injury surveillance and monitoring are based on different regulations. Even when data are widely used for injury monitoring the purpose of data collection for prevention is not officially endorsed. Legislation that mandates data collection for prevention exists for three injury fields: occupational accidents, motor vehicle crashes that lead to compensation claims and fire related accidents. The regulations guiding all other data collections are based on more general legislation (OFS, Causes of death, Care register). It is apparent that when data collection for injury prevention is regulated by legislation, resources and perhaps more systematic enhancement to improve data collection may follow.

10 National viewpoints on local injury monitoring

10.1 Recommendations to improve injury surveillance

Successful injury prevention rests on a foundation of quality injury surveillance data. The first study approach showed that local practitioners have multitudinous data needs, from general incidence and trend data to information on safety behaviour and knowledge among the general population and more targeted population groups. Barriers to conducting injury monitoring and surveillance tasks include organisational barriers to conducting these kinds of activities and difficulties to locate relevant data. The second study approach showed that in order to improve the database for injury surveillance and monitoring at a local level injury registration in EDs is possible, but several barriers need to be overcome. For comprehensive data collection data from both primary health care and from specialised medical care organisations' EDs are needed. In particular it is realistic to expect that data collection from primary health care organisation's EDs will take several years before it can start to produce reliable data for local injury prevention. The preceding substudy showed that Finland has relatively advanced information systems and local injury prevention activity could reap much more benefit from them than they do presently. For that purpose data delivery systems ought to be developed to better serve the local audience.

It is obvious that a myriad of challenges still exists in getting the injury data to hand at the local level. National level policies could support the development of this. In this substudy targets and recommendations proposed by organisations at the national level were studied. Both targets and recommendations will be referred by the term recommendations.

Coveney (2010) argues that public health policy analysis is important for three reasons: public health practitioners have to debate decisions of resource allocation and policy analysis is needed for credible critique, secondly an understanding or analysis of policy is a prerequisite in advocacy work, and thirdly policy analysis becomes crucial to understanding the extent to which the rhetoric is supported by practice. An inventory of Australian recommendations on injury surveillance demonstrated that national policies and strategies to reduce the burden of injury have included 22 recommendations on surveillance since 1986, only three of which had been completely implemented by 2008 (Mitchell et al. 2008). Mackenbach (2011) analysed the English strategy to reduce health inequalities. He argues that despite of some partial success, the strategy failed to reach its targets. According to Mackenbach reasons for failures include: strategies do not address the most relevant entry-

points, did not use effective policies, were not delivered at a large enough scale to for achieving impacts and lacked delivery commitments and budget allocations (Mackenbach 2011).

In this substudy the national recommendations on injury surveillance and monitoring were analysed as representations of what the problem is. The recommendations' potential impact on injury monitoring and surveillance at the local level in the light of the findings from the preceding substudies are discussed. The framework used to categorise the recommendations comes from the EFISS (Mitchell 2008; Mitchell et al. 2009), in which data quality (e.g. data completeness and representativeness) and operational (e.g. data collection process, timeliness, classification system) and practical (e.g. data accessibility, routine data analysis) characteristics of injury surveillance systems are defined as important components of an injury surveillance system.

Reports from committees and working groups and commissioned studies and memorandums from the relevant ministries were reviewed. The document search was limited to the following fields: occupational accident surveillance, traffic accident surveillance and injury surveillance from the public health perspective e.g. injuries in home and leisure time accidents. In addition, documents related to broader safety promotion and the development of national statistical activities were reviewed. (For the list of identified documents with injury surveillance recommendations, see Appendix II.)

During the document search it became evident that national policy processes are different for different injury fields. Target programmes and developmental plans with targets have been published at regular intervals for home and leisure time injury and traffic accident prevention. These documents included several proposals to improve surveillance systems. Similar documents for occupational accident surveillance were not found. The policy process to develop occupational accident monitoring is based on the work of the occupational safety committee. The occupational safety committee is an administrative body, a consortium of three parties: FAII, the most important labour market organisations and insurance companies.

Two general observations were made while reviewing the policy documents. Typically the recommendations are general: " the registers should be developed in view of joint use" (Kautiala et al. 2005) or " Systematic monitoring of the implementation of preventive measures is developed" (Ministry of Social Affairs and Health 2006) or "organisations which produce social, health and education services, and which work in municipalities, develop their information systems in such a way that they include monitoring of injury situations" (Ministry of Social Affairs and Health 2006). Secondly, it is not typical in Finland for policy documents to be structured into three categories: strategy documents, target plans and implementation plans. Strategy documents are rare and implementation plans mostly missing.

10.2 Recommendations as reflections of concerns

Since 1988 a total of 106 proposals to improve injury surveillance were found. Most of the proposals have been published by the Ministry of Social Affairs and Health (a total of 48 proposals) or by the Ministry of Transport and Communications (38 proposals). These numbers include recommendations included in studies that have been commissioned by the ministries.

Recommendations were categorised according to which purpose they were intended to address. The categorisation was not always obvious. For example, the target of the recommendation may be to improve representativeness of the data (= data quality characteristic), but the actual recommendation is: data linkages ought to be possible (=operational characteristic). The recommendation in the above example was categorised as "both data quality and operational characteristics". The decision was always made by asking the question: What is the problem presented to be?

Table 17: Recommendations to improve accident and injury surveillance according to focus

Focus:	N	%
Data quality characteristics	14	13
Both data quality and operational characteristics	8	7
Operational characteristics	37	35
Both operational and practical characteristics	6	6
Practical characteristics	18	17
National organisation	15	14
General improvement	8	7
Total	106	99

Data quality characteristics. Over ten percent (13%) of all recommendations targeted changes in data quality characteristics. Recommendations were addressing concerns in data completeness, specificity and representativeness. Concerns related to data completeness were addressed to Care Register and external cause of injuries –coding (7 recommendations). Also the data completeness of the PATJA information system of police affairs, with special attention to the place of occurrence information in it was a concern (2 recommendations).

Another set of recommendations were those related to specificity: to increase the specificity of the injury surveillance data so that it would allow more specific injury monitoring by type of road user (pedestrian, roller skaters etc), place of occurrence and injury severity. Recommendations related to place of occurrence addressed the exact place of occurrence (GPS coordinates) and coding that would better allow

monitoring of injuries occurring at home. To get representative data on all traffic injury types, including unprotected road users, was a concern in the field of traffic safety in particular. Changes in both data quality and operational characteristics were recommended in order to improve the monitoring of unprotected road users.

Operational characteristics. More than every third of the recommendations were addressing concerns about the operational characteristics (35%) of information systems. In the late 1980s and early 1990s pilot studies were recommended to investigate information systems in the following areas: data collection to monitor injuries in outpatient care and in hospitals and data collections on products involved in injuries. In addition, recommendations for improving the information for death certificates by improving the data available for post-mortem investigations were made. In the 1990s several recommendations seeking possibilities to improve joint-use of medical care based data with data collected by the police in order to improve traffic injury surveillance were made. The recommendations related to enhance information systems for traffic accident surveillance sustained throughout the next decade. In the 2000s it was repeatedly recommended that data collection of injuries in EDs, including recommendation for changes in software used in the EDs. To improve injury data registration in ambulatory care have been made repeatedly for almost 30 years. In the 2000s proposals to initiate and improve of information systems to monitor injuries in schools, day care and elderly care were recommended and appeared as a new aspect. In addition map-based tools for traffic accident data collection and information systems to monitor injury prevention activity appeared. Only one recommendation dealt with legislation in the study period. The assessment of legislation was recommended in order to discover barriers to joint-use of various data sources.

Practical characteristics. Improvement of the practical characteristics of injury surveillance systems has received less attention than operational characteristics. In general recommendations related to practical characteristics were concerned with the lack of injury reports and up-to-date information as well as the availability of information in internet, free of charge. Recommendations related to practical characteristics included: improving communication of emerging injury risks and hazards at work; developing routine data analysis of medical care based data in order to (1) detect emerging injury risks, (2) produce feedback reports for data providers and (3) provide annual statistics on home and leisure time injuries. Further recommendations related to building a portal that would contain information on data sources for statistics in the field of health and social welfare (Ministry of Social Affairs and Health 2003b); and enhancing medical care based data dissemination at the local level directly from local registers. This would require set-up of local registers and information systems that could provide data for local use.

Recommendations related to work at national organisations. Recommendations related to the work carried out at national level organisations were concerned with inter-organisational cooperation and coordination of statistical activities, the lack of permanent funding for important data collections, the lack of or unclearly defined

responsible organisation for surveillance and the lack of injury surveillance capacities among professionals in health care and social work. Respective recommendations were targeted at improvements in cooperation between stakeholders (6 out of 14 recommendations) and funding mechanisms (2 recommendations), the determination of a responsible party for home and leisure time surveillance (2 recommendations) and for traffic accident monitoring (1 recommendation) and the availability of education on surveillance systems (1 recommendation). In addition international and Nordic cooperation were addressed.

General recommendations. Some recommendations were not specific on what they targeted. An example of a recommendation in this category was: "The injury surveillance system should be further developed. Different materials have not been fully utilised in all respects yet" (Ministry of Social Affairs and Health 2003b). However, there were not many recommendations that were not possible to classify in any of the above categories.

10.3 Recommendations with relevance for local injury monitoring

A total of sixteen recommendations were classified as targeting injury monitoring at a local level particularly. This comprised 15% of the recommendations. All the recommendations with the potential to improve local monitoring have been published after the year 2000. In the table 17 recommendations are presented with the researcher's assessment on (1) does the recommendation target data quality, operational or practical characteristics, is it general or does it target other aspects of information system and (2) is the intention of the change targeting local or national organisations.

Table 18: Recommendations with a high relevance for local monitoring

Document	Recommendation	Researcher's assessment
Study report (Rintanen 2002)	The statistical and register authorities have to cooperate closely with such municipalities, which are interested in wider registering of injuries within their own municipality.	(1) General (2) Targets changes in work practices at the national organisations
Study report (Rintanen 2002)	Injury registers must first be established in those offices, where data collection takes place, and the first phase utilisation of the data must take place in the collection place of the data.	(1) Operational (2) Targets changes in work practices at the local organisations
Study report (Rintanen 2002)	At the local level, the reporting and monitoring system should serve the evaluation of interventions.	This relates to the previous recommendation (1) Practical and operational (2) Targets changes in work practices at the local organisations
Study report (Rintanen 2002)	Besides national interests, also local needs must be taken into account.	(1) General (2) Targets changes in work practices at both national and local organisations
Publication of a working group (Ministry of Social Affairs and Health 2003b)	The information which is used in the decision making in official duties and in public (including at the local level) should mostly be available free of charge.	(1) Practical (2) Targets changes in work practices at the national organisations
Study report (Kautiala et al. 2005)	The information and communication related to traffic accident statistics should be improved, statistical information services should be offered to the municipalities since the majority of the municipalities do not have the knowledge, skills or resources to maintain their own statistics.	(1) Practical (2) Targets changes in work practices at the national organisations
Target programme (Ministry of Social Affairs and Health 2006)	Organisations, which produce social, health and education services in the municipalities, develop their information systems in such a way that monitoring of the injury situation is included in them.	(1) Operational (2) Targets changes in work practices at the local organisations
Target programme (Ministry of Social Affairs and Health 2006)	Development of the Centre for Injury and Violence Prevention (START) activities is supported and the experiences from the project are utilised in developing the compilation of statistics of outpatients.	(1) Operational (2) Targets changes in work practices at both national and local organisations
Target programme (Ministry of Social Affairs and Health 2006)	In the nationwide register data information service, municipality-specific indicators are developed.	(1) Operational and practical (2) Targets changes in work practices at national organisations

(Ministry of Transport and Communications 2006a)	The traffic accident investigation board system generates detailed information and encourages proposals for safety improvements. The information and proposals should be used more extensively at both the local and the national level.	(1) Practical (2) Targets changes in work practices at both national and local organisations
Internal safety programme, targets and implementation (Ministry of Interior 2008)	The utilisation of injury data in safety planning is improved by increasing the information exchange between the regional rescue services and the National Public Health Institute (now National Institute for Health and Welfare). Injury data will be processed as part of the risk management of the rescue services, and the information is utilised to improve local safety planning. The rescue services utilise the injury data for assessing the effectiveness of prevention work, and they guide the collection of injury data into a readily usable form at the local level.	(1) Practical (2) Targets changes in work practices at both national and local organisations
National child and youth injury prevention action plan (Markkula et al. 2009)	At the local level, monitoring of injuries and acts of violence is increased in day care, schools and colleges (cf. the START project in the Kouvola region).	(1) Operational (2) Targets changes in work practices at the local organisations
National child and youth injury prevention action plan (Markkula et al. 2009)	Reporting systems for already existing information are developed in such a way that they better serve the users of information at national, regional and local levels.	(1) Operational and practical (2) Targets changes in work practices at the national organisations
National child and youth injury prevention action plan (Markkula et al. 2009)	The data is used in national follow-up, at local and individual levels, as a tool for evaluation of safety work management, planning and quality of operations (schools, day care centres).	(1) Practical (2) Targets changes in work practices at both national and local organisations
Study report (Valtonen 2011)	The PRONTO data location information should be utilised in communication and in road safety work.	(1) Practical (2) Targets changes in work practices at the local organisations
National target plan (Ministry of Transport and Communications 2012)	The accessibility to data, important from the municipality's viewpoint, will be improved; the aim being easy and reliable access for all who need the information	(1) Practical (2) Targets changes in work practices at the national organisations

Out of the 16 recommendations with a high relevance for local injury monitoring none targeted data quality characteristics, four targeted operational, seven practical changes, and five were general or targeted several aspects simultaneously. The need for change focused on national activities in seven of the recommendations, five on local activities, and three on both.

10.4 Summary of results

Local injury monitoring has not been a priority in the national recommendations. From over 100 recommendations only 16 were classified as targeting changes in monitoring at a local level. In general national policy documents recommended enhancing injury monitoring through improved data completeness, representativity, and joint use of the existing data. In addition, recommendations addressed the need to increase inter-organisational co-operation at the national level and to define a responsible organisation to be in charge of home and leisure time accident and traffic accident surveillance. All of the recommendations would improve information systems for monitoring injuries if implemented properly.

Recommendations enhancing local injury monitoring addressed changes in local organisations. Three recommendations were made in the 2000s to enhance information systems in organisations that would collect and process injury information in local organisations such as schools, day care centres, or dwellings for the elderly. The changes would most likely require software updates, and would have an effect on employees daily work practices. As the previous substudies showed, resources for injury monitoring are not easily found and these kinds of changes would require time before this objective is reached.

Recommendations enhancing local injury monitoring targeted changes that address national organisations' work practices. Improving accessibility to existing information and information dissemination practices was a concern in nine recommendations. As the substudy on national data sources showed data dissemination has not been a priority in the national data collecting organisations. Thus the implementation of these recommendations is important in the light of the present study.

11 Discussion and conclusions

An often stated aim for public health is to enhance local level injury prevention and safety promotion activities in order to achieve the national health and safety targets. The present qualitative study investigated information systems for local injury monitoring from four interrelated perspectives. At first local viewpoints on injury monitoring were explored. Secondly injury data collection in emergency departments (EDs) for local injury prevention was studied. Thirdly information systems in national organisations that collect, process and disseminate injury data were analytically reviewed. Fourthly national recommendations on injury monitoring were studied. The way information systems for injury monitoring are defined in the present study are based on the scientific public health and injury prevention literature. The concept of local information system is an ideal model, a multi-dimensional system, where factors related to organisations, employees, environments, and the components of several national statistical systems play a role. The concept of an information system was used as a general term referring to complete systems with data, processing data and data dissemination, as well as technology and people dedicated for injury monitoring.

11.1 Findings

11.1.1 Main findings

From the local injury prevention practitioners' point of view, neither the information nor adequate information systems exist to support injury prevention activities. Information on injuries and accidents is not used for planning, evaluation, informing public and decision makers and policy formulations at a local level. The findings from the local injury prevention point of view are: (1) capacity limitations at local level exist regarding the availability of existing data sources and statistical information systems; (2) weak governance of a multi-sectoral injury monitoring task with no unanimous consensus on who should take the leadership role, this has an impact on receiving information and surveillance, and monitoring. Data available at national level has no clear receiver in municipalities; (3) a community driven and community owned approach for injury monitoring is not a considered priority in developing and building information systems at the national level; (4) there is a lack of important data; (5) there is a lack of well defined national leadership to support the development of comprehensive injury monitoring information systems which would support local injury prevention activity; (6) the existing information systems are stiff and rigid in character; (7) change agents are needed to inspire commitment to change in

EDs; and (8) there is a lack of commitment or recourses to conduct injury monitoring tasks, especially in the primary health care organisation.

11.1.2 Local point of view

- Data requests change from general to specific and more wide ranging as the preventive programmes develop
- Feasible data needs, but no information easily found and in use
- Intentions to use data for evidence based practices, but also as a tool for safety promotion
- Monitoring and surveillance are no-one's work tasks
- Short-term data collections are common, sustainable information system development rare, almost non-existent
- Sustainable data collection almost entirely based on national regulations

Figure 9: Local point of view, main findings

Lack of important information for prevention. The present study found that as community-based injury prevention programmes and coalition building develops, so does the demand for information and respectively for surveillance systems. The numerous information needs brought up by local practitioners correspond with views presented previously (Krug 2004; Langley et al. 2009; McClure et al. 2010; Nilsen 2006; Simpson et al. 2003). The finding that there are changing information needs is in alignment with previous studies (Schaechter et al. 2007) and supported by the community readiness model (Donnermeyer et al. 1997; Stallones et al. 2008).

The public health literature on injury surveillance emphasises the value of emergency department and inpatient care data (Annest et al. 2008; Ekman et al. 2008; Quigg et al. 2011; Svanström et al. 1995). Also the WHO promotes the sharing and use of ED data as a major component in the public health approach to prevent injuries (Holder et al. 2001). The present study suggests that alongside medical care based information systems, serious efforts must take place to develop and promote information systems for other types of information. Information needs at the local level extend beyond mere injury incidence information to such areas as safety knowledge and safety behaviours of the population, long-term consequences and the societal cost of injuries.

Two different aims seem to exist to justify the information use: firstly to conduct evidence based injury prevention and secondly to use injury information as a practical tool for advocacy, to convince decision makers, to inform the general public, and also to educate staff while they are collecting data in order to improve the quality of

services. The first justification gets most of the attention in injury surveillance literature and also guides the framing of surveillance research (see, Nilsen et al. 2007). The findings of this study are supported by earlier studies that have pointed out that injury surveillance systems ought to be designed for a wider audience, e.g. to be used in advocacy, and that surveillance systems' purpose and utilisation ought to extend beyond those for whom the surveillance was originally conceived (Schaechter et al. 2007).

For evidence based injury prevention good quality surveillance on all injury types are needed. The present study demonstrated that, at the present time, national data sources are not able to form a comprehensive picture of injuries in Finland. Weaknesses are related to data quality, representativeness and the availability of information on factors associated with injury incidences. The Care register, the database that would be most appropriate in providing representative information on all injuries for local injury monitoring, is weakened by a poor completeness rate of the injury specific variables. This is repeatedly demonstrated and has been shown earlier in several independent studies from abroad and Finland (Lunetta et al. 2008; McKenzie et al. 2009; Stokes et al. 2000). However, high quality population-based injury data could assist health and safety promotion co-ordinators and practitioners at the local level. Information from medical care based information systems may be the most useful in informing about the general picture of injuries and providing trend information for evaluating the effects of preventive activities in the long run. This kind of information is repeatedly requested by directors in the municipality. The CDC has published strategies to improve the coding of injury specific variables (Annest et al. 2008). They recommend: improving communication among stakeholders; developing quality assurance practices, an on-going evaluation of data quality and feedback procedures; developing training curricula; and improving the usefulness and use of data by improving communication on the use of this data for injury prevention efforts.

Evidence based injury prevention is based on reliable data that could indicate important points of action and the present study on local practitioners' viewpoints showed that data that would flag important action targets is frequently requested. Population based information systems that collect data on injuries, but lack detailed data on factors associated with injury occurrences, are not sufficient alone. For local injury prevention data on injury occurrences that have intimacy to local actors are requested: where, to whom and in what circumstances have the injuries occurred. Information on accident places, hazardous environments or helmet use is asked for. Only limited information on injury circumstances is available from the national information systems. Accident investigations would have such data. However, nowadays they are conducted on regular basis for all fatal or severe fire-related, occupational and motor vehicle accidents. In addition, administrative registers that collect information on these accidents contain more information on injury circumstances than medical care based information systems. The data available for these injury

types are important and most likely they have contributed in injury reductions. However, it may be unrealistic to expect that in the near future accident investigations would cover a much wider spectrum of injuries. Fire-related, occupational and motor vehicle accidents form 20–30% of all fatal or severe injuries.

Since the current information systems are not able to provide information on hazardous environments at the local level, new methods have been proposed that would rely on citizen participation (Lehtinen et al. 2008). These information systems are based on the idea that municipal employees are not able to identify all hazards. Thus citizens' active participation ought to be encouraged. In these models the responsibility of the municipality is to provide information systems for citizens to report on safety hazards. Information systems like these and actions taken based on these systems are supported by Reason, who argues that attempts to discover and neutralise latent failures will have a greater beneficial effect upon system safety than localised efforts to minimise active errors (Reason 1990, 173).

Barriers at the local level in making effective use of the existing data. The present study supports the notion that a continuing challenge for injury surveillance is making effective use of the existing data (Horan et al. 2003). Despite the existent information needs and justifications thereof, the existing data on injuries and accidents are not in use in community-based injury prevention programmes targeting all ages, environments, and situations. In this study the identified barriers at local level are: limited knowledge of existing injury data, a vague understanding of the data contents and wheather the data can be accessed, a lack of resources to conduct information seeking activities and the fragmentation of data into various information systems. In addition local data already collected in hospitals and emergency clinics is retained as their own knowledge and does not reach the wider audience conducting preventive work. Difficulties in building links between data collected during medical care and information needs for prevention have been reported in earlier studies (Shipton et al. 2008; Timpka et al. 2008).

Weak governance of a multi-sectoral task with no unanimous consensus on who should take leadership. The present study indicated that at a local level the responsibility to collect injury related information is not defined to any party. Clearly changes in work practices are needed at a local level to improve injury monitoring and to prepare injury reports for prevention. The expression of change means that organisations involved with monitoring change and persons working within various organisations start to work differently, with tasks they previously did not have, using tools they previously did not have and building links to organisations that previously did not exist. The present study strongly indicates that, at a local level, within organisations participating in multi-actor inter-sectoral injury prevention activity organisational change poses a challenge.

Short-term data collections instead of investments to sustainable information systems. Instead of investments in continuous data collection and building sustainable information systems for injury monitoring, short-term data collections on specific,

narrowly defined injury topics are all too common in the Finnish municipalities. Local practitioners, however, indicate an interest in developing data collection for injury surveillance. In order to do that they need approved and tested models. The models should not be limited to health based injury incidence data collection systems. Data collection at the local level is strongly influenced and determined by factors external to local organisations. National level regulations almost entirely define data collection at the local level. Thus the national level injury surveillance capacities, decisions and level of cooperation affect local level injury surveillance and are needed in order to move towards a more informed injury prevention activity at the local level.

11.1.3 Injury data collection in emergency departments

- Complexity of the classification system: regular contact and possibility to negotiate with a competent injury specialist supports the implementation process
- Usability of the application: to achieve user acceptance of the used application for injury registration it is essential that the application supports the actual work process in a smooth way
- Official endorsement: successful adaptation of new systems such as injury registration is critically dependent on top managements' public endorsement
- Established practices to introduce new tasks support the adaptation

Figure 10: Injury data collection in emergency departments, main findings

The present study investigated injury data collection in two EDs in Finland. The conceptual framework for innovation dissemination in health care organisations presented by Greenhalgh and colleagues (Greenhalgh et al. 2004; Greenhalgh et al. 2008) were used in data analysis. The change model as a whole consisted of the adding of data fields into the existing software of the electronic patient journals, education of the data entrants, injury data subtraction from the data sources, analysis of data and sharing the information. The present study was limited to the initiation of the data collection.

Multiple ED related factors are associated with the success of injury registration. The pace of work, properties of the software used in data entering, communication culture among nurses and pre-existing practices in the organisation to introduce new tasks and the alignment of injury registration with existing organisational routines

are organisational antecedents strongly associated with the success of injury data collection in EDs. It is difficult to say if some factors are more important than others. Since sustainable injury data collection in EDs has not proved to be easy and results from previous studies support findings of this study (Liu et al. 2009; Lund et al. 2004; Ross et al. 2003; Simpson et al. 2003; Spinks et al. 2004), it may be so that the threshold to being indifferent to collecting injury data is low. This could mean that even slight inconveniences in data collection leads to deterioration of the data collection.

Usability of the application for injury registration was critical. Several studies have demonstrated a poor user acceptability of software that does not support practical work. Deficiencies in health care information systems are a common topic of public discussion today. However, earlier studies on information systems for health promotion have suggested that modifications of the data entry systems may not be sufficient to achieve user acceptability (Timpka et al. 2008). Practitioners participating in data entering are usually organisationally far from those participating in health promotion and feedback from data users and visualising the full circle of information and knowledge management have been suggested to support the data collection tasks (Shipton et al. 2008; Timpka et al. 2008).

In the EDs studied for this research it was critical that education and support was provided for the personnel. The injury data collection model using the ICD 10 classification for the external causes of injuries is not simple and may be a source of frustration and coding errors. Support was received from colleagues in the EDs and from an injury specialist; both were valued by personnel in the EDs. Investments in personnel resources as a prerequisite for high quality injury registration have been reported in earlier studies (Lund et al. 2004; Shipton et al. 2008). Discussing the logic, and highlighting the importance, of not using the "unspecified" codes is important. It seems to be necessary that at least at the initiation phase those responsible for data entering have an opportunity to discuss and have easily available advice about ambiguous cases.

Data collection in the primary health care organisation's ED posed obstacles that did not arise in the specialised medical care context. Injury registration in the primary health care organisation faced same difficulties in the Finnish context that have been reported earlier from other countries (Lund et al. 2004; Ross et al. 2003; Simpson et al. 2003). If the injury data collection contributes to other targeted areas in the primary health care organisation, such as reduction of harm caused by alcohol misuse, the motivation to collect injury data may be increased. It may be so that a critical factor in the primary health care is adequate resources. Without personnel resources appointed to injury registration or possibilities to slow down the pace of work, injury registration in the primary health care organisations is most likely to continue to be difficult to conduct. In addition, a decisive stance from those responsible may be needed to get started. It may even be so that the data collection model applicable in the specialised medical care context is not applicable in the primary

health care context. Anyhow, injury data collection in EDs in the primary health care context is not easily done.

National policies addressing injury data collection improvements in the EDs should consider carefully what the prerequisites for injury registration are and address recommendations to those prerequisites. Nowadays outpatient data collection including injuries is mandatory for national statistics (Care register) in Finland. It will be a challenge to collect high quality data nationwide in the near future. Injury specific initiatives to support injury data collection nationwide in the primary health care organisations seem to be essential based on the present study results.

Change agents are needed to inspire commitment to changes in EDs. A competent and trustworthy change agent with injury specific knowledge is likely to be an essential part of the process of change in EDs. This finding is supported by previous studies (Lund et al. 2004; Shipton et al. 2008). Further more involvement of, and support from, the municipality who intends to use the data is important. This is also in alignment with previous findings (Nordqvist et al. 2009; Quigg et al. 2011). Building sustainable injury registration systems in EDs has proved to be difficult (Simpson et al. 2003; Spinks et al. 2005; Shipton et al. 2008; Spinks et al. 2009; Timpka et al. 2009), yet data collections in Denmark (Odense), Norway (Harstadt) and Sweden (Linköping) have existed for several decades.

11.1.4 National point of view

A total of 22 national information systems collecting data on injuries with the potential to provide information for local injury prevention activity were identified. In addition over 100 recommendations have been made since the end of the 1980s to improve injury monitoring.

- Data completeness. Data collections do not cover all types of injuries - > incomplete picture of injuries in general and of specific injuries with public health importance
- Information and data dissemination:
  - In most cases municipal based data are not delivered in an easily accessible format
  - Several dissemination channels and formats -> dissemination practices do not support comprehensive local injury prevention approach
- Statutory information systems for prevention cover occupational injuries, traffic injuries known to police or occurring with insured vehicles, fire-related injuries
- Timeliness and data collection processes are rated as very good or good
- No implementation plan for important national recommendations
- No defined national leadership

Figure 11: Potential of the national data sources, main study results

Community driven and community owned approach for injury monitoring is not a considered priority in developing and building information systems at the national level. Based on the present study the national data sources serve local audiences poorly. Results are consistent with those of earlier studies and discussion papers which have remarked that surveillance system are often structured in a manner that divorces the information collected from those positioned to make use of it (Auer et al. 2001; Johnston 2009; Pless 2008).

Local information collected by national agencies seems to stay to a large extent in the data collecting organisations. It is possible that national structures are nebulous and thus also recipients of information at the local level have not been identified by the data collecting organisations. Most likely more clearly identifiable local injury prevention structures and local actors are recognised for traffic, occupational and fire-safety fields. For local community-based injury prevention activity with an all-injury all-age group orientation the recipient of information is not easily perceived. Indeed, local community-based multi-sectoral injury prevention programmes are still rare in Finland. However, several national initiatives do support the enhancement of safety and health promotion activity at the local level and the current situation may change in the future. The internal security programmes (Ministry of Interior 2004; 2006; 2008) aim to create multi-sectorial safety promotion bodies in regions and local communities. Also the Health Care Act

(1326/2010) aims to improve monitoring of health and well-being of citizens at the local level. The act states:

> Local authorities shall monitor the health and welfare of their residents and any underlying factors per population group as well as any measures taken with regard to local authority services that are aimed at meeting the welfare needs of residents. Reports on the health and welfare of residents as well as any measures taken shall be produced for the city or municipal council once a year, in addition to which a more comprehensive review on welfare shall be produced for the city or municipal council once during each term of office. Local authorities shall assign coordinators for health and welfare promotion. The various local authority departments shall work together in health and welfare promotion. Moreover, local authorities shall cooperate with other public organisations based in the local authority as well as with private enterprises and non-profit organisations.

Data from national data sources is not made easily available for local data users. The present study on national information systems demonstrated that data collecting organisations have each developed data dissemination practices for their own audiences. The fragmented nature of information was also remarked on by local practitioners trying to compile reports on local injury situations. The fragmented nature of injury surveillance has been pointed out in previous studies (Horan et al. 2003; Kisser et al. 2009). One of the criteria in the injury surveillance guidelines is simplicity (CDC 2001; Holder et al. 2001). If the current situation is viewed from the point of view of a local practitioner the diversity of information sources cannot be rated as a network of simple and accessible information systems. Since all data collecting organisations have their own important collaborative networks, which often are not injury specific organisations, it may be necessary to assess if an officially endorsed data clearinghouse for local level injury monitoring should be established in Finland.

Based on the assessment using the rating criteria in the EFISS (Mitchell 2008; Mitchell et al. 2009) the national data sources in Finland rate as very good in timeliness and good or very good in data collection processes. A time lag of information is commonly brought up in discussions and supported by study reports (Timpka et al. 2008). No one would argue that more timeliness information would be good but from the local information user perspective timeliness should not divert attention from other more important items that should be developed in the future.

Lack of well defined national leadership to enhance local injury monitoring. The present study showed that stakeholders of various information systems are developing dissemination systems independently. Local injury monitoring would most likely benefit from more coordinated activities at the national level. The task of enhancing local injury monitoring for injury prevention using comprehensive approaches is currently not allocated to any organisation. National policy recommendations ad-

dress cooperation between data collection organisations and also cooperation of such municipalities that are interested in enhancing injury monitoring at the local level. Implementation of these recommendations would most likely support enhancing local monitoring.

11.2 Strengths and limitations of the study

The present study that explored injury monitoring for local preventive activity from the public health perspective in the Finnish context may be the first study in this field. The need to study the topic is both scientific and practical. The scientific community has somewhat conflicting views on what kind of data and information systems would have the most positive impact and be cost effective in providing the information for local injury prevention. But also the researcher's participation in local injury prevention programmes had an impact on the choice of the research topic. Information on injuries with local relevance was frequently asked for. However, where the requested information should be obtained from was not obvious. The aim of the present study was to generate knowledge that would have practical value in enhancing information systems for injury monitoring to support prevention at the local level.

Local practitioners' viewpoints on injury information, information seeking and information systems were based on data collected from municipalities that have experience in community-based local injury prevention. This ensured that informants were knowledgeable. A total of 48 persons representing several professions attended focus group interviews. In addition real time data collection during the site visits, meetings and seminars ensured that data represented a range of views. (Rapley 2005, 17.) Qualitative data instead of data collected by questionnaires were preferred to gain direct information from the study participants without theoretical preconceived perspectives (Hsieh et al. 2005). The strength in using focus group interviews is that the group can provide prompts to talk, correcting or responding to others. The limitation is that group interviews work better with participants who have well-developed routines for talking to each other. (Macnaghten et al. 2005, 65-74.)

The focus group interview data were collected at the beginning of the 2000s. There are reasonable grounds to think that one limitation of this study is out of date data. Indeed, it is not possible to assess in a reliable way with the data on hand if the situation has changed in Finland. The retrospective data collected during the developmental programmes and based on individual professionals comments suggest that some changes may have taken place. Individual local professionals are better aware of injury data sources for monitoring, or see the value of the data collection in spite of the extra work generated by it. Professionals met during the injury prevention programmes cannot be seen as representing local professionals as a whole. Instead they were met due to their acquaintance with injury prevention and most likely represent forerunners in the field. It could be assumed that the identified barriers of lim-

ited knowledge on available injury data, a vague understanding of data contents and wheather the data can be accessed and data utilisation barriers related to the lack of organisational readiness and resources to work with surveillance data still exist at the local level in most parts in Finland.

The two cases selected for the study on injury data collection in EDs were the first EDs to start detailed data collection on injuries in Finland as a routine task to support prevention. As in the first substudy, direct information from knowledgeable participants representing a range of views was preferred. The total number of interviewed people was ten. The rational in selecting the study participants was to have representation from the most important parties in enhancing the injury registration in EDs. All interviews were conducted, analysed and coded by the researcher.

The results of the second substudy are strongly context dependent. The professionals used as informants cannot be seen as representing all professionals even in their own working environments and organisations. The rational for selecting the interviewees was to get a range of views. Though interviewee selection was done carefully, some important views may not have been covered. Generalisability of the results was not the main purpose of study. However, many of the findings of the second substudy are supported by previous studies indicating that similar results may appear in other contexts.

Data of existing information systems are based on several data sources: published studies, descriptions found in documents, information available on data administrators' internet pages, personal or group interviews, and personal contacts by phone, e-mail or meetings. The data collection for the third substudy was challenged by several factors. The first step was to identify data sources. Even though the researcher has over twenty years experience in the injury field, new data sources previously unknown to the researcher emerged during the interviews. The second step was to collect data about each information system. It became apparent that plenty of information is tacit knowledge among experts. For the Official Statistics of Finland (OSF) standard methodology descriptions are generally found. But for many information systems, even though they are sustainable, methodology descriptions are not well prepared. To avoid misunderstandings and ensure the correctness of the results, descriptions of data sources were circulated among key informants.

The level of analysis in the third substudy was not as detailed as the evaluation framework would have allowed and the reasoning was based on knowledge collected from experts and grey literature to a large extent. Only a limited number of published studies on national information systems were identified. Injury prevention and safety promotion is a multidisciplinary field and studies on injuries are published in scientific journals of various disciplines. The search may not have captured all published studies causing unnecessary uncertainty. In addition, the use of actual data from information systems would have improved the reliability of the results. The analytical descriptions of the existing data sources have to be seen as a first step for more focused and detailed studies in the future.

The fourth substudy used national policy documents as data. The strength related to policies is that they are produced in committees representing and summarising various stakeholders' viewpoints. A limitation is that not all ministries and stakeholders are involved with the injury prevention, safety promotion or public health policy processes. In Finland consumer safety affairs are under the jurisdiction of the Ministry Employment and the Economy, sport affairs in the Ministry of Education and Culture and standards related to buildings and environments in the Ministry of the Environment. Even though the most central documents were in the data, it is possible the all viewpoints may not have been present in the selected 22 policy documents.

The quality of qualitative research refers to the transparency of the whole research process (Seale et al. 2005, 407). The research has been described in detail from data collection and analysis to presenting the results to ensure the transparency. The detailed description also ensures transferability of the research to other contexts.

11.3 Perspectives for further development and future research

Among the main findings of the study is that local injury prevention practitioners are missing the data that they require for prevention. Capacity limitations and knowledge gaps exist at the local level regarding existing information systems. Further, national organisations that collect data for statistics and surveillance have each developed data dissemination systems independently, and a fragmented data dissemination practice exists. In addition, data gaps exist. Data collected by national organisations does not fully meet the information needs of local professionals and among the study municipalities sustainable data collections for injury monitoring was not a reality. The prevailing situation is far from the state targeted in national policies.

A challenge for the future is to enhance local community driven approaches in developing information systems for injury monitoring. First local structures and commitments to conducting injury-monitoring activities ought to be strengthened and established. Second cooperation between local practitioners, safety and health promotion leaders and national data collecting organisations ought to be advanced. Further, a community driven approach could benefit from the enhancement of data sharing practices at the local level. Data collected by the Police and rescue service authorities seem to be better available at the local level. This is not a common practice and other possibilities to enhance data sharing at the local level ought to be investigated. Local injury prevention and monitoring of injuries would benefit from closer co-operation between EDs and injury prevention practitioners.

Injury monitoring at the local level would benefit from efforts that promote coordination and integration of injury data dissemination from existing national data sources. A comprehensive view on injuries, instead of fragments of information, would better serve the public health interest. National structures, resources and leadership to improve comprehensive injury monitoring ought to be established. Binding

legislation defines responsible organisations and financing of insurance based traffic and occupational accident surveillance systems. Also monitoring of fire-related accidents is a statutory activity of the rescue service authorities. Possibilities to support comprehensive injury monitoring by legislation ought to be investigated.

Capacity building and education to advance injury surveillance and monitoring ought to be promoted. Education curriculums need to be investigated and alternative models to improve injury surveillance education of health care and other professionals developed. Continuing education and awareness of raising the importance of data collected during medical care are needed in EDs and hospitals to improve injury registration, data completeness and accuracy of injury related data. In addition, models to support actual injury registration work in EDs and hospitals need to be investigated and developed. Differences in their preparedness to adopt injury registration in the primary health care and specialised medical care contexts should be taken into account in developing the registration models and support structures.

National level policies could support the enhancement of injury monitoring at the local level. Yet the recommendations need to be implemented. An implementation plan, sufficient resources and an adequate national governance structure are needed to achieve the actions recommended in national health and safety policy documents. Several policy recommendations target improvements in data completeness, representativeness and joint-use of injury data. High-quality scientific studies on data quality characteristics would guide the target setting in future policy documents. Few policy recommendations target changes in data dissemination practices and cooperation between data collecting organisations. Recommendations to improve the processes of building sustainable local information systems for injury monitoring ought to be seen more often in future policy documents.

Acknowledgements

This study was carried out at the National Institute of Health and Welfare (THL), its predecessor the National Public Health Institute (KTL) and the University of Tampere. I would like to thank the Assistant Director General, Professor Erkki Vartiainen of THL for maintaining a tolerant and encouraging research environment in the Welfare and Health Promotion Division. My compliments go to my superiors Professor Antti Uutela and Adjunct professor Pirjo Lillsunde, to all my former STAKES colleagues, current and former THL colleagues, especially in the Injury Prevention Unit and to numerous other colleagues in Finland and abroad. The discussions we have had and the encouragement I have received from so many of you have all been important.

There are some individuals, who have been especially important to this study and for myself. My deepest gratitude goes to Professor Juhani Lehto and Professor Jorma Saari, my supervisors. Your wisdom and sense in scientific matters, as well as your friendliness, have meant a lot to me. Juhani, the feedback I have received from you throughout the process and up until the last minute, has been essential. The fact that you have always made yourself available when questions have arisen, has made working with you an easy path. Jorma, your profound theoretical understanding of injury prevention has been valuable. I am happy that you many years ago introduced me to the world of injury research.

Professors Tiina Laatikainen and Mika Gissler are kindly acknowledged for their expert reviewing and valuable comments on my work. Your advise has been valuable to me during the final stages of this thesis. I am grateful to adjunct professor Jari Parkkari for accepting the role as opponent to my thesis. I would also like to warmly thank Thomas Blenkow for aiding me with the English language.

An important supporter for me during this study has been Professor Lucie Laflamme from the Karolinska Institutet (KI). Lucie, I am truly thankful for the possibility to work at KI. I am happy that I had an opportunity to get to know researchers from all over the world while working at the Division of Global Health, ICHAR, at KI. Special thanks go to Lucie and Adjunct Professor Marie Hasselberg for reviewing my thesis at an early stage.

My research would not have been possible without all the people in the municipalities. Thank you all for the hospitality, kindness and cooperation that I have greatly enjoyed during injury prevention projects in the past and hope to enjoy in the future. You have been the driving force of my work.

My dear and, every now and then, crazy friends: Juha, Tiina, Marja, Seppo, Heidi and others, my life would have been much more boring if you had not been around.

Finally, I want to thank my family and extended family. I consider myself fortunate with so many of you around. My parents, Markus and Leila, you have always encouraged me, whatever decisions I have made. I am so glad you can see this process come to an end and share it with me. Peppe, you have shared my frustrations perhaps more than anyone else. Thank you for your help and being so calm during the stressful and hectic moments. Aleksi, Joonas and Tuomas – hope to see you and your friends around more often. This particular process is over now.

Espoo 29.9.2012

Anne Lounamaa

Appendix 1: Existing data sources for injury surveillance in Finland

Administrative registers

	Name	*Statistical Unit*	*Number of cases*	*Injury/ accident classification*	*Case definition*	*Data, process into the national register*	*Responsible authority, (owner)*	*For further information*
Health and social welfare registers								
	1. Cause of death statistics [1]	Death	Total of 49 093 deaths, 3 052 due to injuries or intoxications in 2007.	ICD -10, International version	Persons who have died in Finland or abroad and who at the time of death were domiciled in Finland.	Statistics are compiled from data obtained from death certificates, which are supplemented with data from the population information system of the Population Register Centre. 100% coverage	Statistics Finland	Statistics Finland/Cause of death statistics. http://www.stat.fi/til/ksyyt/index_en.html,
	2. Care register, inpatient hospital care[2]	Inpatient or day surgery discharge and patient census at the year-end	~1.3 million discharges annually. 100 617 due to injuries or intoxications in 2007.	ICD-10; Finnish version	Inpatient care and day surgery in hospitals and health centres.	Statistics are compiled from individual level data obtained from the hospitals. Data are based on all discharges annually and inpatients on 31.12. 100% coverage.	THL	http://www.stat.fi/til/thlaho/index_en.html

1 Statistics Finland/Cause of death statistics. http://www.stat.fi/til/ksyyt/index_en.html, last visited 29.10.2009, Discussion Anne Lounamaa/Jari Hellanto (Statistics Finland) 27.7.2010, personal communication Anne Lounamaa/Ursula Vala (THL/Forensic Medicine) 27.7.2010

2 Statistics Finland http://www.stat.fi/til/thlaho/index_en.html, last visited 29.10.2009 and THL http://www.stakes.fi/FI/tilastot/tausta/Aineistokuvaukset/terveydenhuollonlaitoshoito.htm, last visited 29.10.2009

	3. Care register, social welfare institutional care and housing services[3]	Periods of care completed during the year and client census at the year-end	164 262 completed periods of care in 2010, for 100 reason for care = injury, 94 200 clients in client census 31.12.2010, for 104 reason for care= injury.	ICD-10; Finnish version, not a mandatory field.	Completed period of care in residential homes, sheltered housing units with 24-hour assistance for older people; in institutional care and housing services with 24-hour assistance for people with intellectual disabilities; sheltered housing units with 24-hour assistance for people with severe disabilities and psychiatric patients; detoxification and rehabilitation centres operated as part of services for substance abusers, and sheltered housing with part-time assistance. A client-specific data are also collected on all clients in institutional care and housing services at the end of the year.	Statistics are compiled from individual level data obtained form the social welfare service providers.	THL	THL, http://www.stakes.fi/EN/tilastot/statisticsbytopic/socialservices/datadescripcarehousing.htm

3 Statistics Finland http://www.tilastokeskus.fi/meta/til/shlaitasup_en.html, last visited 1.9.2012 and THL http://www.stakes.fi/EN/tilastot/qualityreports/careandhousing.htm, last visited 1.9.2012 and THL (2011): Institutional Care and Housing Services in Social Care in 2010. Statistical report 26/2011.

	4. Finnish register on visual impairment[4]	Person with visual impairment.	13 new patients for whom the reason for visual impairment was an injury in 2011 Total number of persons with visual impairment 17 000 in 2011	Visual impairment is classified with a special ophthalmologic classification based on ICD 9th version, external cause code not used	The corrected visual acuity is permanently less than 0.3 in the better eye, or if the person must for some other reason be considered comparable with a person with permanent visual impairment as described above	Notification made by a specialist in ophthalmology or the ophthalmological unit of a hospital and sent to the Finnish Federation of the Visually Impaired.	THL and the Finnish Federation of the Visually Impaired.	Finnish Federation of the Visually Impaired, http://www.nkl.fi/fi/etusivu/tietoa/nvrek
Registers of the Police and rescue service authorities								
	5. The information system of police affairs (PATJA), Death investigations[5]	Death	Total of 13 598 death investigations in 2008, due to injuries – information not available	Death, codes for suspected suicide and drowning.	If an illness as a cause of death is not known or if the deceased has not been treated by a physician or if the cause of death has been a crime, an injury, a suicide, poisoning, occupational disease or treatment or when there is a reason to suspect any of the above reasons or if the death occurred otherwise suddenly.	Report written by police visiting the accident site. Close to 100% of deaths occurring elsewhere than in a hospital or nursing homes.	National Police Board	--

4 Finnish Federation of the Visually Impaired http://www.nkl.fi/fi/etusivu/tietoa/nvrek, last visited 3.9.2012 and personal communication Anne Lounamaa/Matti Ojamo 1.8.2012

5 Personal communication Anne Lounamaa/Yrjö Tiippana 16.3.2010 and 26.4.2011; personal communication Anne Lounamaa/Risto Niskanen 8.4.2011; Act on establishing the cause of death (459/1973).

	6. The information system of police affairs (PATJA), road traffic accident investigations[6]	Road traffic accident	Total of 25 434 traffic accidents, 206 accidents with fatal injuries, 226 fatal injuries; 4 638 accidents with non-fatal injuries, 6 015 non-fatal injury cases in 2008.	Classified into two categories: death, injured	Traffic accidents, where police have been present.	The data on traffic accidents are entered into the PATJA by local police districts compile the database	National Police Board	--
	7. The rescue services resource and accident statistics (PRONTO) [7]	Operation by rescue service authority	Total of 101 439 operations, in which 623 deaths (from all causes) and 10 310 non-fatal injury cases in 2009.	Classified into three categories: people in immediate danger of injury, injured, dead.	All rescue service operations.	Reports written by rescue service authorities compile the database.	Ministry of the Interior/ Emergency Services College	Emergency Services College, http://prontonet.fi/

6 Personal communication, Anne Lounamaa/Yrjö Tiippana (National Police Board) 16.3.2010; personal communication Anne Lounamaa/Risto Niskanen 8.4.2011

7 Emergency Services College/PRONTO online data-base, http://prontonet.fi/, last visited 6.12.2009; personal communication Anne Lounamaa/Esa Kokki 23.3.2010

Specific traffic accident registers								
	8. Statistics on road traffic accidents[8]	Accident	6 881 road traffic accidents involving personal injury in 2008	Classified into two categories: death, injured	Traffic accident investigated by police, supplemented with data from other registers.	Data from the information system of police affairs (PATJA) on road traffic accidents are transferred to Statistics Finland. Data from police are supplemented with data from the Finnish Transport Agency and from Statistics Finland's statistics on causes of death.	Statistics Finland	Statistics Finland, http://www.stat.fi/til/ton/index_en.html
	9. Road traffic accidents in highways - Statistics[9]	Road traffic accident	3 577 personal injury accidents in which 224 fatalities and 4 578 non-fatal injuries in 2008.	Classified into two categories: death, injured	oad traffic accident in highways.	Finnish Transport Agency receives highway traffic accident data from Statistics Finland and supplements it with road and traffic data.	Finnish Transport Agency	--
	10. Road and cross-country traffic accident statistics[10]	Insured vehicle accident	Total of 99 272 accidents, in which 18 600 bodily injury cases in 2008.	Classified into 3 categories: minor injuries, serious injuries, deceased.	Road traffic accident compensated from Motor Liability Insurance	The file is built from compensated accidents. Insurers' claims handlers record the data that is forwarded to Finnish Insurance Data Ltd who makes the database available for FMIC.	FMIC	FMIC, http://www.liikennevakuutuskeskus.fi/www/page/lvk_www_2434,

8 Statistics Finland, http://www.stat.fi/til/ton/index_en.html, last visited 18.6.2009

9 Personal communication Anne Lounamaa/Auli Forsberg (Finnish transport Agency) 25.2.2010 and Finnish Road Administration (2009): Traffic accidents on highways in 2008. Helsinki. Finnish Road Administration. Finnra statistics 3/2009.

10 The Finnish Motor Insures' Centre/Road accident statistics of insurance companies, http://www.liikennevakuutuskeskus.fi/www/page/lvk_www_2434, last visited 28.1.2010; Personal communication Anne Lounamaa/Veikko Valkonen 28.1.2010, group interview at FMIC 22.2.2010

Specific occupational accident registers								
	11. Statistics on work accidents and occupational diseases[11]	Person injured in a work accident or diagnosed with an occupational disease	143 487 injured in work accidents (workplace and commute) that insurance companies paid compensations in 2007	ESAW (European Statistics on Accidents at work)	An occupational injury for which compensation from an insurance company was received.	The statistics are compiled from data on compensated occupational injuries from the member institutions of FAII. The member institutions are obliged to provide FAII information necessary for compiling and maintaining statistics.	FAII	Federation of Accident Insurance Institutions (FAII) http://www.tvl.fi/www/page/tvl_www_1809
	12. Work accidents of farmers and people with grants and scholarships (since 2009)[12]	Person injured in a work accident	5 795 farmers' work accidents in 2007.	ESAW (European Statistics on Accidents at work)	An occupational injury of a farmer's or receiver's of a grant or scholarship compensation covered by MELA,	Statistics are formed as a by-product of insurance activity	MELA	Farmers' social insurance institution (MELA) http://www.mela.fi/526/Insured-wellbeing
	13. Occupational accident statistics[13]	Work accident (workplace and commute) compensated by insurance	149 000 work accidents for which insurance companies paid compensation in 2007.	ESAW (European Statistics on Accidents at work)	An occupational injury that has occurred to a wage or salary earner or own-account worker in agriculture or a person with grant or scholarship for which insurance institutions have paid compensation.	Statistics are created as a by-product from insurance activity. Statistics Finland receives the data from the FAII, State Treasury and MELA.	Statistics Finland	Statistics Finland, http://www.stat.fi/meta/til/ttap_en.html

11 Federation of Accident Insurance Institutions (FAII), Employees accidents and occupational diseases: http://www.tvl.fi, last visited 10.2.2010; phone discussion Anne Lounamaa / Janne Sysi-Aho (FAII) 11.2.2010; FAII and Ministry of Social Affairs and Health: Työtapaturmien luokittelu. Opas työpaikkojen käyttöön. [Occupational Injury Classification, Manuscript for Employers]. 2002.

12 Farmers' Social Insurance Institution, Social Insurance of Finnish farmers: http://www.mela.fi/526/Insured-wellbeing, last visited 1.3.2010

13 Statistics Finland, Occupational accidents: http://www.stat.fi/til/ttap/2007/ttap_2007_2009-11-30_tie_001_en.html , last visited 3.5.2012

Other registers								
	14. Sickness allowances[14]	Recipient and new spell of sickness allowance	Total of recipients 318 036 out of which 50 974 due to injuries and total of new spells 331 601 out of which 47 514 in 2010 (dg: S00 – T99)	Disease causing incapacity for work, international ICD-10 classification on 3 digit level, external cause codes not used	100% recipients of sickness allowance 100% new spells of sickness allowance	All residents of Finland are insured under the Health Insurance Act. The processing system for the benefits produces an individual-level benefit database, which forms the basis for the statistical files.	KELA	KELA, http://www.kela.fi/in/internet/suomi.nsf/NET/011001094800TL?OpenDocument

14 The Social Insurance Institution (KELA). Tilastollinen vuosikirja 2010 [Statistical yearbook 2010], electronic book: http://www.kela.fi/it/kelasto/kelasto.nsf/alias/Sava_10_pdf/$File/Sava_10.pdf?OpenElement, last visited 28.3.2012

Emerging information systems – Registers

	Name	*Statistical Unit*	*Number of cases*	*Injury/ accident classification*	*Case definition*	*Data, process into the national registry*	*Responsible authority, (owner)*	*For further information*
	15. Care register, Outpatient visits in specialised health care[15]	Outpatient visit	Total of 7.6 million outpatient visits, 318 5031 due to injury or intoxication and number of injury patients 159 550 in 2009.	ICD; Finnish version	Emergency care visit in specialised hospitals, exact coverage per hospital not known, but most hospitals provide data.	Statistics are compiled from individual level data obtained from the hospitals. Coverage unknown.	THL	--
	16. Care register, Outpatient visits in primary health care[16]	Outpatient visit	The number of recorded visits increases annually, however, only a few hospitals provide patient level data in 2010.	ICD; Finnish version	Emergency care visit in a primary health care hospital or a clinic.	Statistics are compiled from individual level data obtained from the hospitals and clinics. Coverage by hospital or clinic not known, national coverage unknown, but low.	THL	THL, http://www.thl.fi/fi_FI/web/fi/tilastot/tiedonkeruut/avohilmo
	17. FINJURY	Fatal injuries, hospital inpatient care periods and outpatient discharges	Total of 3904 fatalities, 136 313 care periods and 378755 outpatient discharges	ICD-10, international for fatal national for non-fatal	Fatal , inpatient and outpatient treated injuries	The database is annually compiled with data extracted from the Causes of death statistics and from the Care register	THL, Injury prevention unit	--

15 THL/ http://www.stakes.fi/FI/tilastot/tausta/Aineistokuvaukset/erikoissairaanhoidonavohoito.htm, last visited 29.10.2009; Personal communication Anne Lounamaa/Simo Pelanteri 8.3.2010, THL/Ambulatory care in specialised medical care 2009. http://www.stakes.fi/FI/tilastot/aiheittain/Terveyspalvelut/avohoito/erikoissairaanhoito.htm, last visited 29.3.2011

16 Personal communication Anne Lounamaa/Simo Pelanteri 8.3.2010

Emerging information systems - Surveys

	Name	*Sample selection method*	*Sample size, response rate*	*Statistical unit*	*Data collection method*	*Number of injury cases*	*Main question*	*Responsible authority, (owner)*	*For further information*
	18. Health and well being survey (ATH), Currently on pilot phase [17]	Regionally representative sample, the probability to be selected when 75 years and over is two-fold when compared to other age groups.	Sample size is ~3000 per 20 000 population of the region.. Response rate in survey conducted in 2010 was 50%	20 years old and older Finns	Postal interview, possible to answer online	Results vary by region	Have you been injured in an traffic accident/leisure time accident/other accident during the past 12 months? Injury treatment? Questions on use of safety devices: safety belt on car's back seat, bicycle helmet, life vest in a boat etc.	THL	www.thl.fi/ath

17 THL, ATH study: www.thl.fi/ath, last visited 3.4.2010; Personal communication Anne Lounamaa/Risto Kaikkonen 29.3.2010

Accident investigation databases

	Name	*Unit*	*Number of investigations*	*Data , process into the national registry*	*Responsible authority (owner)*	*For further information*
	19. Register of road and cross-country traffic accident investigations[18]	Fatal road and cross-country traffic accidents in Finland. 100 % coverage	Approximately 450 investigations annually	Reports of accidents investigated by road accident investigation teams form the database. Injuries classified according to ICD, AIS, ISS.	FMIC	FMIC, http://www.liikennevakuutuskeskus.fi/www/page/lvk_www_2434
	20. Register of Occupational Accident investigations[19]	Fatal occupational accident in Finland, 100 % coverage	Approximately 30 – 40 investigations annually	Reports of the investigation teams form the investigation database.	FAII	FAII, http://www.tvl.fi
	21. Investigations of major accidents[20]	Major accident: A life threatening event in which several people died or there was a high probability of several fatalities	Approximately 60-70 investigations annually	Trained accident investigation teams conduct the investigation, write a report, which then will be available on the organisation's internet base.	Safety Investigation Authority	Safety Investigation Authority, http://www.turvallisuustutkinta.fi/en/Etusivu

18 The Finnish Motor Insures' Centre, http://www.liikennevakuutuskeskus.fi/www/page/lvk_www_2434, last visited 28.1.2010; phone discussion Anne Lounamaa/Veikko Valkonen 28.1.2010; interview 22.2.2010;

19 Personal communication: Anne Lounamaa/Janne Sysi-Aho 11.2.2010

20 Safety investigation authority http://www.turvallisuustutkinta.fi/en/Etusivu, last accessed 7.9.2012

	22. Investigations of occupational accidents database, TAPS[21]	A serious or fatal occupational accident in Finland	250 narratives/investigations in 2009.	Database is compiled of narrative descriptions of serious or fatal occupational accidents. Descriptions are produced by occupational safety and health inspectors at Regional State Administrative Agencies or by FAII.	Administrator: The Regional Safety Administrative Agency of the Western and Inner Finland	--

21 Occupational safety and health portal: http://www.tyosuojelu.fi/fi/tapaturmaselostusrekisteri (only available in Finnish), last visited 29.3.2011

Surveys on injury prevention activity and practices

	Name	*Sample selection method*	*Sample size, response rate*	*Respondents*	*Data collection method*	*Main question*	*Administrator, (owner)*	*For further information*
	23. Barometer of maintenance of workability, every 3rd year, since 1998	1000 workplaces, random sample using stratified sampling, Stratification criteria: Region, Number of employees, Employer: private, municipal, sate/government	Employers' response rate 99%, Employees' Response rate 92%, occupational health providers' response rate 89%, in 1998	Representatives of employers, employees and representatives of occupational health providers	Computer aided telephone interview	Questions on work safety practices	Finnish Institute of Occupational Health (FIOH)	FIOH: http://pre20031103.stm.fi/suomi/hao/julkaisut/haosisallys228.htm
	24. Barometer of working conditions, annually since 1992[22]	Random sample from the labour force	1059, 83.6 % in 2009	18 – 64 year old persons in workforce (regular working hours at least 10 hours/week)	Computer aided telephone interview in October	Questions on opinions of the working environment safety and if the safety at work is improving, violence at work, physically strenuous work	Ministry of employment and the economy	Last available publication with the questionnaire, October 2010, available at http://www.tem.fi/files/27208/TEM_34_2010_netti.pdf

22 Ministry of Employment and the Economy: Barometer of working conditions. October 2009. MEE Publications: Employment and entrepreneurship 34/2010. Access method: http://www.tem.fi/files/27208/TEM_34_2010_netti.pdf

	25. Quality of work life survey, every 5th-6th year since 1977[23]	Sample from the labour force survey	Between 3000 and 6500 respondents, non-response rate 8 – 22%	Person in workforce (regular working hours at least 10 hours/week)	Personal face-to-face interviews using a standardised questionnaire.	Have you been injured during the past 12 months in an occupational accident that lead to days of absenteeism from work? How many days were you absent from work? Also questions on perceived threats of accidents and violence and on occupational safety and health organisation at workplace.	Statistics Finland	Statistics Finland: http://www.tilastokeskus.fi/til/tyoolot/index_en.html, Publication with questionnaire: http://www.stat.fi/tup/julkaisut/tiedostot/isbn_978-952-467-930-5.pdf
	26. TedBM survey on health promotion practices within municipality. 2004, 2007, 2011[24]	All municipals in Finland	195 municipalities, 58% of all municipalities in 2011	Municipal directors together with other municipal leaders.	Questionnaire on web	Does the municipality have an inter-sectorial programme/strategy to prevent injuries? To prevent violence and promote safety? Are the national health promotion targets (e.g. prevention of injuries among young men) targeted in the municipality's programme/strategy?	THL	THL: http://info.stakes.fi/TedBM/FI/index.htm

23 Official Statistics of Finland (OSF): Quality of work life survey [e-publication]. Helsinki: Statistics Finland [referred: 12.3.2012]. Access method: http://www.tilastokeskus.fi/til/tyoolot/index_en.html.

24 Tukia H. et al. (2011) Väestön hyvinvoinnin ja terveyden edistäminen kunnassa. Perusraportti kuntajohdon tiedonkeruusta 2011. [Promotion of wellbeing and health of the population by local authorites – Basic report on data collection on municipal management 2011] Report 55/2011. THL

	27. TedBM survey on school health promotion[25]	Compulsory schools in 2007 and 2009 Vocational schools in 2008, High Schools in 2008	1803 compulsory schools in 2009, response rate 63%; 192 vocational schools in 2008, response rate 84%;	Headmaster	Compulsory schools: Web-questionnaire, Vocational schools and high schools: combination of postal and online questionnaire.	Compulsory schools: Does your school have a systematic monitoring system for school injuries that covers: (a) injuries in the school and in the school yard, (b) on the way to and from school, (c) while the pupil is moving from one location to another during school hours? How many school injuries have been treated by (a) a nurse, (b) by a medical doctor, (c) by a dentist during the academic year? Additional questions on school environment and if any safety hazards have been recorded during an environmental investigation?	THL	http://info.stakes.fi/TedBM/FI/index.htm

25 Rimpelä M. et al. (2010) Hyvinvoinnin ja terveyden edistäminen perusopetuksessa [Welfare and health promotion within the comprehensive school system in 2009]. Opetushallitus [The Finnish National Board of Education]. Koulutuksen seurantaraportti 2010:1, Väyrynen P. et al. (2009) Hyvinvoinnin ja terveyden edistäminen ammatillisissa oppilaitoksissa. Perusraportti kyselystä vuonna 2008. [Welfare and health promotion in vocational schools in 2008. Basic report of a survey in 2008]. THL and Opetushallitus [The Finnish National Board of Education]. Rimpelä M. et al. (2009) Hyvinvoinnin ja terveyden edistäminen lukioissa. Perusraportti kyselystä vuonna 2008. [Welfare and health promotion in high schools in 2008. Basic report of a survey in 2008]. THL and Opetushallitus [The Finnish National Board of Education].

	28. TedBM survey on health promotion within primary health care in health centres 2003, 2006, 2008, 2010[26]	All local/regional primary health centres	N=231, response rate 83% in 2008	Health centre management team	Online questionnaire	Is reduction of violence and injury related mortality among young men included in the targeted activity? Does your organisation have an implementation plan to reduce home and leisure time accidents? Does your organisation have a common practice to identify elderly with an increased risk of falling? Has your organisation practiced a mass media campaign in the injury field?	THL	http://info.stakes.fi/TedBM/FI/index.htm

26 Saaristo, V., Alho, L et al (2010): Terveydenedistämisaktiivisuutta perusterveydenhuollossa kuvaavat tunnusluvut ja niiden raportointi – menetelmäraportti. [Benchmarking of Health Promotion Capacity Building in Primary Health Care – Development of Indicators.] THL Discussion Papers 10/2010. Helsinki.

Population surveys

	Name	*Sample selection method*	*Sample size, response rate*	*Respondent*	*Data collection method*	*Number of injury cases*	*Main question*	*Administrator, (owner)*	*For further information*
	29. School Health Promotion Study, from 1995 data collected biannually[27]	All schools are invited, since municipalities pay a share of the costs, not all schools are attending	107 666 pupils in 2008 (Southern and eastern Finland, Lapland), 73 717 pupils in 2007 (Central Finland, Åland).	Pupil in 8th or 9th grade at upper level of compulsory school, (14-15 year olds) and 1st or 2nd year pupils at high or vocational school (16-17 years)	Questionnaires answered in a classroom setting	23 686 in 2008	During this school year have you had an unintentional injury at school or during the school journey for which you needed to visit a medical doctor or a public health nurse?	THL	http://info.stakes.fi/kouluterveyskysely/EN/index.htm
	30. National victimisation survey, 1980, 1988, 1996, 2000, 2003, 2006, 2009[28]	Random sample from the population census	9 576, 75.1% in 2009.	A Finn of 15 years or older	Telephone interview	1 372 in 2009	During the past 12 months have you been injured in an accident? The questionnaire contains several specific questions on home, leisure, sport, work and traffic injuries, their circumstances and consequences.	The national Research Institute of Legal Policy (Optula) and THL	http://www.thl.fi/fi_FI/web/pistetapaturmille-fi/tilastot/tapaturmatilasto-inti-suomessa/kansallinen-uhritutkimus

27 THL, School health survey: http://info.stakes.fi/kouluterveyskysely/FI/index.htm, last visited 11.3.2010
28 THL, Victimization survey, THL: http://www.ktl.fi/portal/suomi/yhteistyoprojektit/tapaturmat/tapaturmat_lukuina/kansallinen_uhritutkimus/, last visited 27.3.2011

	31. Health behaviour among the Finnish adult population (AVTK), annually from 1978[29]	Random sample from the population census	5 000, 64% in 2008	14-64 years old Finn	Postal survey	570 in 2008	Have you had any unintentional injuries in the list below during the last year (12 months) for which you needed medical doctors care? 4 questions on health behaviour related to safety.	THL	http://www.ktl.fi/portal/suomi/osastot/eteo/yksikot/terveyden_edistamisen_yksikko/tutkimus/elintapaseurannat/aikuisvaeston_terveyskayttaytyminen
	32. Health behaviour among the Finnish elderly (EVTK), From 1985 biannually[30]	A stratified random sample from the population census	2 400, 77% in 2007	65-84 years old Finn	Postal survey	194 in 2007	Have you had any unintentional injuries in the list below during the last year (12 months) for which you needed medical doctors care? 2 questions on safety related health behaviour and one on safety of home environment.	THL	http://www.ktl.fi/portal/suomi/osastot/eteo/yksikot/terveyden_edistamisen_yksikko/tutkimus/elintapaseurannat/elakeikaisen_vaeston_terveyskaytt-aytyminen/

29 THL, Health behaviour among the Finnish adult population –study:
http://www.ktl.fi/portal/suomi/osastot/eteo/yksikot/terveyden_edistamisen_yksikko/tutkimus/elintapaseurannat/aikuisvaeston_terveyskayttaytyminen, last visited 11.3.2010

30 THL, Health behaviour among the Finnish elderly –study:
http://www.ktl.fi/portal/suomi/osastot/eteo/yksikot/terveyden_edistamisen_yksikko/tutkimus/elintapaseurannat/elakeikaisen_vaeston_terveyskayttaytyminen/, last visited 11.3.2010

	33. The European School Survey Project on Alcohol and Other Drugs (ESPAD), from 1995 every 4th year[31]	Data collected from voluntarily participating schools	5 396, 90.5% in 2007	Pupils that turn 16 years during the calendar year of data collection	Questionnaires answered in a classroom setting	As a consequence of alcohol use 15% of respondents experienced an injury.	Because of your own alcohol use, how often during the last 12 months have you experienced the following? … b. accident or injury … Because of your own drug use (for example cannabis, ecstasy or amphetamines), how often during the last 12 months have you experienced the following? … b) Accident or injury …	THL	http://www.espad.org/
	34. The Adolescent Health and Lifestyle Survey in Finland, Biannually since 1977, Last time injury questions were included in 2009[32]	Random sample	10 000, 61% in 2007	12-18 years old Finn	Postal survey, a possibility to answer online.	2009 results on injuries not available.	2009 questions: Have you experienced an injury or accident during the last year while doing sports: (a) at sports club, (b) at school (c) during leisure time?	University of Tampere	--

31 The European School Survey Project on Alcohol and Other Drugs (ESPAD): http://www.espad.org/, last visited 2.1.2010

32 Rainio S et al. (2009) Nuorten terveystapatutkimus 2009. Tupakkatuotteiden ja päihteiden käyttö.[The adolescent health and lifestyle Survey 2009. Adolescent smoking, alcohol and substance use in 1977 - 2009], last day accessed 7.9.2012. http://www.stm.fi/c/document_library/get_file?folderId=39503&name=DLFE-10634.pdf

	35. Health Behaviour in School-aged Children (HBSC) study, 1983/1984 and 1985/1986 since then every 4th year[33]	Cluster sampling, the unit is school class/school	For each age group 11, 13 and 15 a sample of around 1 500 young people. In 2006 the total sample size was 5193.	A Finn of 11, 13 or 15 years old	Questionnaires answered in a classroom setting	Percentage of injured, Age: for boys/girls 11: 45%/38% 13: 45%/37% 15: 44%/37%	How many times during the past 12 months have you been injured so that you have been treated by a doctor or a nurse?	University of Jyväskylä and WHO	University of Jyväskylä: https://www.jyu.fi/sport/laitokset/tutkimusyksikot/tetk/en/projects/who HBSC-Study internet pages www.hbsc.org/
	36. Traffic behaviour monitoring, annually, since 1992[34]	Data from several studies	Data from several studies	Data from several studies	Data from several studies	Not relevant	Driving speeds of cars (Road Administration, Liikenneturva) Time distance between cars (Road Administration, Liikenneturva) Use of seatbelts by car drivers and front seat passengers (National Traffic Police, Liikenneturva)	Liikenneturva	Liikenneturva: http://www.liikenneturva.fi/www/en/index.php

33 The Health behaviour in School-aged Children (HBSC-Study) https://www.jyu.fi/sport/laitokset/tutkimusyksikot/tetk/en/projects/who, last day accessed 7.9.2012 and HBSC-Study internet pages http://www.hbsc.org/, electronic publication: Social determinants of health and well-being among young people. HBSC study. International report from the 2005-2006 survey. at http://www.euro.who.int/__data/assets/pdf_file/0003/163857/Social-determinants-of-health-and-well-being-among-young-people.pdf, last day accessed 8.10.2012

34 Liikenneturva (2012): Monitoring traffic behaviour. http://www.liikenneturva.fi/www/en/research/behaviour_monitoring.php, last day accessed 29.3.2012

							Use of seatbelts by private cars' back-seat passengers (Liikenneturva) Car drivers' signalling upon making a turn (Liikenneturva) Alcohol consumption cases in the flow of traffic (University of Helsinki, National Public Health Institute, National Traffic Police) Use of bicycle helmet (Liikenneturva) Compliance with traffic lights by pedestrians (Liikenneturva) Pedestrians' use of reflector (National Public Health Institute, Liikenneturva) Use of children's safety seats (Liikenneturva) Compliance with traffic lights by drivers (Liikenneturva)		

	37. Traffic Climate evaluations, annually, since 1992[35]	Car drivers' licence holders from a representative sample of the Finnish population	About 1000 drivers, response rate not relevant, always around 1000 respondents[36]	Person with a driver's licence	Telephone interview till 2009 after that web-based questionnaire, collection of data is continued till 1000 respondents have been reached, data collection done by a commercial data collection company	Not relevant	Drivers are asked about their opinion on: Positive characteristics - Politeness and flexibility - Caution while passing - Abiding by the rules of traffic - Friendliness and helpfulness - Adjusting to traffic jams - Taking care of safety - Thanking others Negative characteristics - Speeding - Cutting in - Intimidating traffic - Selfish driving habits - Restlessness in traffic jams - Tailgating - Disregard for rules - Respecting others'	Liikenneturva	Liikenneturva: http://www.liikenneturva.fi/www/en/index.php

35 Liikenneturva (2012): Traffic Climate evaluations. http://www.liikenneturva.fi/www/en/research/trafficclimat_evaluation.php, last day accessed 29.3.2012
36 Pöysti, L (2012): Oma ja muiden toiminta liikenteessä. Tieliikenteen ilmapiiri vuonna 2011. [Own and others action in traffic. Traffic Climate in 2011], http://www.liikenneturva.fi/www/fi/tutkimus/liitetiedostot/Liikenteen-ilmapiiri--2011.pdf, last day accessed 29.3.2012

							rights - Taking risks while passing - Causing harm on purpose		
	38. Work and health survey, every 3rd year[37]	Random sample of employed Finnish speaking persons from the population census.	5 700, 59% in 2009	25 – 64 years old Finn	Telephone interview	11% of respondents in 2009	Over the past 12 months, when at work or commuting to or from the work, have you been in an accident that has caused at least a minor injury? To what extent doest the following factors cause risk of an accident in your work? A list of factors presented.	Finnish Institute of Occupational Health (FIOH)	--
	39. The National FINRISK study, 5 year intervals[38]	Independent, random and representative population samples from different parts of Finland	11953, 67% in 2007	25 – 74 years old Finn	Questionnaire and on site medical examinations	1853 in 2007	Have you experienced an injury during the last year (last 12 months) for which you needed to visit a doctor?	THL	http://www.ktl.fi/portal/english/research__people_programs/health_promotion_and_chronic_disease_prevention/units/chronic_disease_epidemiology_unit/the_national_finrisk_study/

37 Perkö-Mäkelä et al (2010) Työ ja terveys haastattelututkimus 2009. [Work and health survey 2009]. Electronic publication. http://www.ttl.fi/fi/verkkokirjat/tyo_ja_terveys_suomessa/Documents/tyo_ja_terveys_haastattelututkimus_2009.pdf. last visited 8.10.2012

38 THL, National FINRISK study: http://www.ktl.fi/portal/english/research__people___programs/health_promotion_and_chronic_disease_prevention/units/chronic_disease_epidemiology_unit/the_national_finrisk_study/, last visited 27.3.2010; Personal communication Anne Lounamaa/Markku Peltonen 17.3.2010

	40. Health 2000 follow up study, Health and functional capacity of Finns – national health survey, approximately 10 year intervals[39]	A nationally representative two-stage cluster sample has been drawn, which comprises 10,000 persons and 80 regions (municipalities or groups of municipalities with joint primary care). All 15 bigger cities and towns are included in the sample.	10 000, Follow up study for the original study population, a young cohort added each year	18 years old or older Finn	Persons aged 30 or over person to person interview and health examination, younger adults 18-29 interview only,	19% of interviewed men and 9% of women reported having a permanent injury or disability due to an accident	A permanent injury or defect caused by an accident, questions on place of occurrence, cause and type of the injury, and consequences for health and functional capacity.	THL	http://www.terveys2000.fi/indexe.html,
	41. Citizens' views and knowledge on rescue services, every 3rd year since 1992[40]	Omnibus survey	~1000	A Finn 15 years or older	Telephone interview	Not relevant	Questions on safety knowledge and safety behaviour.	Ministry of Interior	--

39 THL, Health 2000 study: http://www.terveys2000.fi/indexe.html, last visited 27.3.2010

40 Personal communication Lounamaa/Peltomaa 11.3.2010

Appendix 2:
Policy documents and studies with recommendations on injury surveillance

Public health and safety policy documents and study reports commissioned by the ministry with recommendations on injury surveillance

1988. Developmental plan for prevention of home and leisure time accidents for years 1988 – 1990 (National Board of Health 1988)
1991. Prevention of home and leisure time injuries. Development plan 1991 – 93 (National Board of Health and Welfare 1991)
2000. Injury Situation and Safety Culture. Targets for the prevention of home and leisure accident injuries (Ministry of Social Affairs and Health 2000)
2002. The current and future injury statistics in Finland. The EU's EHLASS system as a starting point for home and leisure time injury statistics (Rintanen 2002)
2003. Report of the Working Group on Social Welfare and Health Care Information Reform 2005 (Ministry of Social Affairs and Health 2003b)
2006. Safe at home and at leisure. Target programme for the prevention of home and leisure accident injuries for 2007 – 2012 (Ministry of Social Affairs and Health 2006).
2008. Safety first – internal security programme (Ministry of Interior 2008)
2009. Providing a safe environment for our children and youth. The national action plan for injury prevention among children and youth (Markkula et al. 2009)
2010. A report on cooperation and division of statistical work between the Ministry of Social Affairs and Health, National Institute of Health and Welfare and Statistics Finland (Statistics Finland and Ministry of Social Affairs and Health and THL 2010).

Finnish traffic safety policy documents and study reports commissioned by the ministry with recommendations on injury surveillance

1995. The information system development to monitor bicycle accidents and bicycle use. (Ministry of Transport and Communications 1995)
1997 The representativeness and the coverage of the road traffic accident statistics and promoting and facilitating the common use of the road traffic accident data-banks – a study plan. (Ministry of Transport and Communications 1997)
1998 Completing the Information on Road Traffic Accidents –An experiment on Combining the Registers (Ministry of Transport and Communications 1998)
2000 Development of Traffic Accident Statistics on the Basis of the Göteborg Action Model. (Ministry of Transport and Communications 2000)
2001 Government resolution on improving road traffic safety 18.1.2001 (Ministry of Transport and Communications 2001)
2005 Clarifications of the current situation and needs for development concerning the statistics about traffic accidents (Kautiala et al. 2005)
2006 Road Safety 2006-2010 (Ministry of Transport and Communications 2006a)
2006 Government resolution on improving road traffic safety 9.3.2006 (Ministry of Transport and Communications 2006b)
2008 Traffic accidents among cyclists, motorcyclists and mopedists – Study of accidents that led to specialised healthcare in Northern Kymenlaakso, Finland (Airaksinen 2008)
2011. Seriously injured in road traffic accidents according to the database of the fire and rescue service (Valtonen 2011)
2012. From goals to reality. Road traffic safety plan till 2014. (Ministry of Transport and Communications 2012)
2012. A Proposal for Amending the Statistics Act (Ministry of Finance 2012)

Finnish occupational safety policy documents and study reports commissioned by the ministry with recommendations on injury surveillance

2011. Decreasing the Number and Severity of Occupational Accidents and Injuries – Action Plan. (Ministry of Social Affairs and Health 2011)

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